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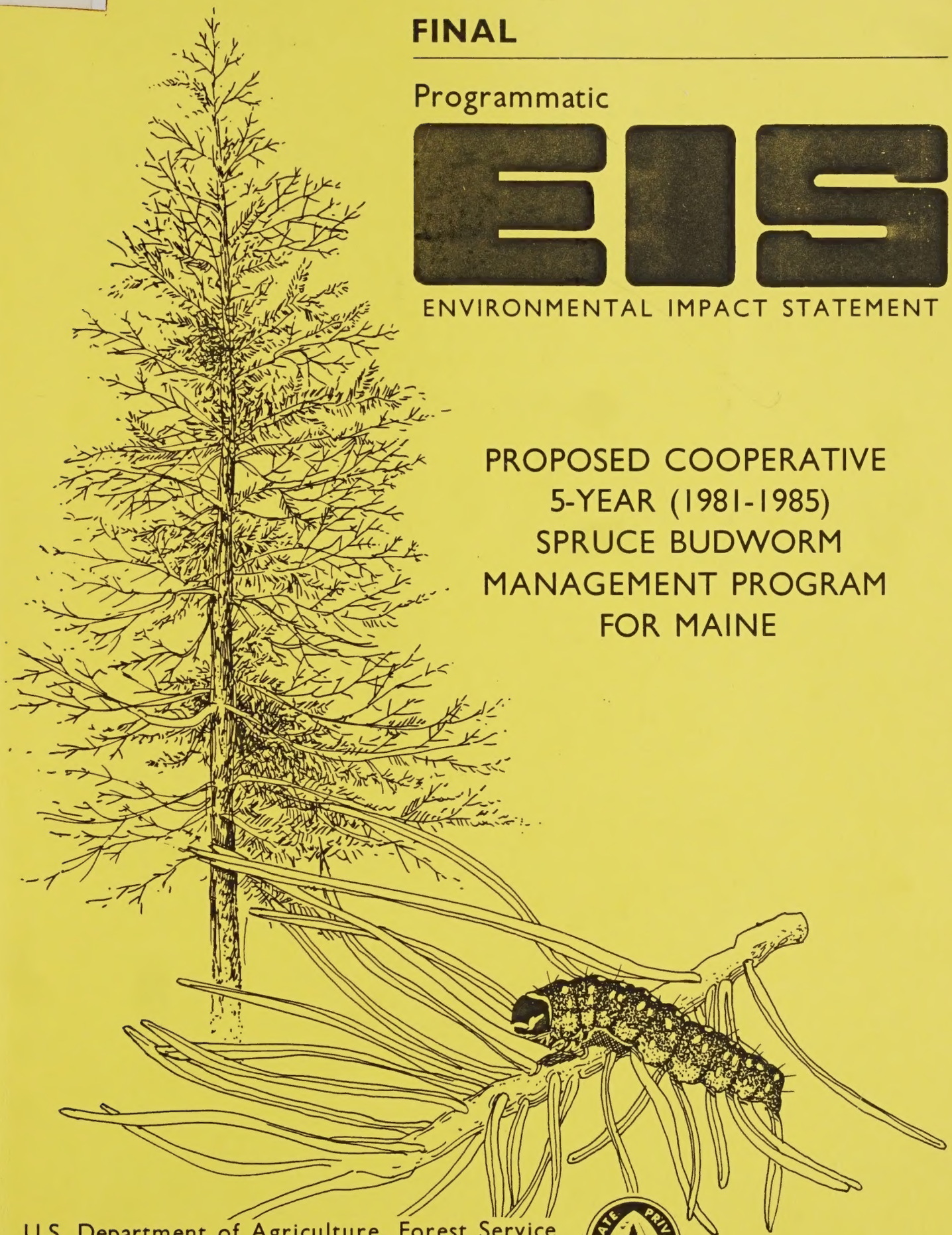
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ENVIRONMENTAL IMPACT STATEMENT

PROPOSED COOPERATIVE 5-YEAR (1981-1985) SPRUCE BUDWORM MANAGEMENT PROGRAM FOR MAINE

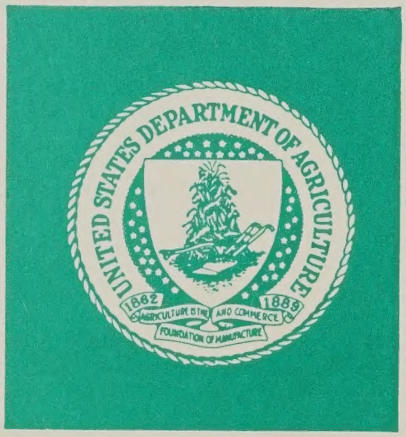


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FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT
USDA-FS-NA-81-01

PROPOSED
COOPERATIVE 5-YEAR MAINE SPRUCE BUDWORM MANAGEMENT PROGRAM

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Abstract: The Maine Department of Conservation, Bureau of Forestry, has proposed a 5-year (1981-1985) spruce budworm Integrated Pest Management (IPM) program, and has indicated USDA Forest Service financial assistance may be requested annually for major portions of the program. The proposed 5-year program would affect the counties of Aroostook, Piscataquis, Somerset, Penobscot, Washington, Franklin, and Hancock. As required by the National Environmental Policy Act (NEPA) of 1969, the USDA Forest Service in cooperation with the Maine Bureau of Forestry conducted an environmental analysis of the proposed program. Five alternatives were identified and examined during the analysis: (1) IPM involving an increase in silviculture and utilization-marketing, while the use of chemicals and biologicals remains constant; (2) IPM involving an increase in silviculture and utilization-marketing, while the use of chemicals is reduced and the use of biologicals remains constant; (3) IPM involving an increase in silviculture and utilization-marketing, while the use of chemicals is reduced and the use of biologicals is increased; (4) IPM involving an increase in silviculture and utilization-marketing, while the use of chemicals is eliminated and the use of biologicals is greatly increased, (5) No Action (Makes no provision for any spruce budworm management except salvage and other harvesting). The alternative program selected by the USDA Forest Service is IPM involving an increase in silviculture and utilization-marketing, while the use of chemicals is reduced and the use of biologicals is increased (Alternative 3). If implemented, this selected alternative would guide USDA Forest Service consideration of requests for financial assistance that may be received from the Maine Bureau of Forestry over the next 5 years to carry out a spruce budworm IPM program. Requests for financial assistance will be considered annually on an individual basis. Annual decisions on USDA Forest Service financial assistance will be based on the results of an annual site specific environmental assessment carried out in accordance with the National Environmental Policy Act.

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SUMMARY

The Maine Department of Conservation, Bureau of Forestry, has proposed a 5-year (1981-1985) Integrated Pest Management (IPM) program for the spruce budworm and indicated that USDA Forest Service financial assistance may be requested for major portions of the program. The 5-year program was proposed in response to the continuing threat of spruce budworm to the Maine spruce-fir resource. The IPM program would be applied to all of Maine's spruce-fir resource since all of this resource, about 8 million acres, is susceptible to the spruce budworm. The President's 1979 Environmental Message to Congress described IPM as "a systems approach to reduce pest damage to tolerable levels through a variety of techniques, including predators and parasites, genetically resistant hosts, natural environmental modifications and, when necessary and appropriate, chemical pesticides".

In response to the Maine Bureau of Forestry's request, the USDA Forest Service as required by the National Environmental Policy Act (NEPA) of 1969 conducted the environmental analysis documented here. During the analysis five alternatives were examined. Except for no action, each alternative consisted of a combination of three or four kinds of spruce budworm management methods. The alternatives considered were as follows:

(1) An increase in silviculture and utilization-marketing while the use of chemicals and biologicals remains constant. This alternative would allow for protection strategies similar to those of the past 5 years. Protection of stands would permit an orderly increase in silvicultural management and utilization marketing in areas treated with insecticides. However, it could lead to dependence on insecticides and reluctance of some landowners to invest in other methods. Effects on non-target organisms would not differ from that of the past 5 years.

(2) An increase in silviculture and utilization-marketing while the use of chemicals is reduced and the use of biologicals remains constant. Under this alternative, protection would be sufficient to ensure an orderly increase in silviculture and utilization-marketing. Some tree mortality would be expected to occur in untreated areas and those areas treated with B.t. Expected short-and long-term effects of insecticides on populations of some non-target organisms would be less than that of the past 5 years.

(3) An increase in silviculture and utilization-marketing, while the use of chemicals is reduced and the use of biologicals is increased. This objective would be brought about by more thorough and precise forest measurements to ensure that only the most productive stands would be protected while non-productive or marginal stands would be removed from protection. Expected short-and long-term effects of insecticides on populations of some non-target organisms would be much less than the past 5 years.

(4) An increase in silviculture and utilization-marketing, while the use of chemicals is eliminated and the use of biologicals is greatly increased. Here intensified planning and precise application would become critical. For example, while planned management activities might be foregone harvesting operations would be concentrated primarily on spruce budworm killed or threatened stands. Further, much of the dead timber might not be salvaged. Except for short-term effects on some moth and butterfly species in target areas, the effects on non-target organisms would be minimal.

(5) No action (Makes no provision for any spruce budworm management except salvage and other harvesting). Without any tree protection, widespread mortality could occur, severely restricting management options on timber lands. Industrial landowners might be forced to restrict harvesting activities to their own lands. This could result in severe losses on the smaller, private, non-industrial lands. The impact on other forest organisms would be minimal to insignificant.

The proposed IPM program would be applied to the 8 million acre Maine spruce-fir forest since all of this forest is susceptible to the spruce budworm. Of the 8 million acres susceptible to the spruce budworm, only a maximum of about 5 million acres are expected to be in high or extreme hazard condition over the next 5 years. Under the first alternative, all of these 5 million acres would be protected by application of insecticides to about 1.9 million acres annually over the next 5 years. Under the second alternative, 3 million acres in high or extreme hazard condition would be protected by annually applying insecticides to about 1.4 million acres over the next 5 years. Under the third alternative, these 3 million acres would be protected by precisely targeting insecticides to about 1.1 million acres annually over the next 5 years. Acreage treated with insecticides under each of the alternatives could vary from year to year depending upon biological need. Under the first three alternatives some portions of the areas protected would be treated with insecticides two or more times over the next 5 years. Under the fourth alternative, about 1 million acres would be treated with a biological insecticide which would be applied annually to about one-half of this area. To help reduce future wood supply disruptions the area protected with insecticides would include a combination of mature and immature stands. During the past 5 years (1976 to 1980) about 5 million acres of Maine's spruce-fir resouce then in high or extreme hazard conditions were protected by use of insecticides. During this

period of time, an average of 1.9 million acres out of the 5 million acres were treated with chemical or biological insecticides each year.

Under the first four alternatives, silvicultural and utilization-marketing methods would be applied primarily to portions of the vulnerable resource not protected with insecticides. Emphasis in unprotected areas would be on harvest of dead, dying, and threatened or vulnerable trees.

Application of the proposed IPM program would require close cooperation between the Maine Bureau of Forestry, private forest landowners and mill owners. The Maine Bureau of Forestry would administer application of chemical and biological methods while private forest landowners and mill owners would be primarily responsible for application of silvicultural and utilization-marketing methods. IPM programs would vary among landowners and mill owners depending on such factors as species, market requirements and spruce-fir management goals.

Recently adopted State legislation is expected to foster IPM implementation. This legislation provides for such measures as a spruce-fir supply-demand analysis, and State General Fund support for IPM activities. Beginning in October 1981 the Maine Bureau of Forestry will request from each landowner, as a requirement for spray program participation, a 5-year cutting plan and other management information necessary for spray project and management program planning.

Research and application projects sponsored by the USDA Forest Service are expected to contribute to the success of the proposed IPM program. The Canada-United States Spruce Budworms Program (CANUSA) sponsors several research and demonstration projects in Maine. These projects are developing new spruce budworm management technology and encouraging use of existing technology. New technology developed over the next 5 years may be incorporated into an IPM program. A survey of Maine's forest resource is currently being conducted by the Northeastern Forest Experiment Station. The survey will provide new information on the status of Maine's spruce-fir wood supply.

Major Issues, Concerns, and Opportunities

Major issues, concerns, and opportunities identified during the scoping phase of the environmental analysis were: the potential threat of spruce budworm to the State's economy; need to initiate a long term management program to replace the past short term approach; concern that a long term IPM program might not be significantly different from the past approach; need for continued reliance on insecticides as a major part of any IPM program; concern that long term undetected

adverse effects may occur in humans exposed to insecticides, insecticide application problems such as drift and pilot safety; possible adverse effects of spruce budworm impacts on small non-industrial lands; and extent to which the general public may benefit from possible Federal financial assistance for spruce budworm management.

Affected Environment

All alternatives may affect several biological, physical, economic, and social factors in the human environment. Biological factors considered in the analysis were the spruce budworm; the spruce-fir resource; humans including permanent residents, visitors, and workers in the spruce-fir forest; fish and wildlife including endangered species; and non-target organisms including aquatic insects and bees. Physical factors include large streams, lakes, and organic farms. Economic factors potentially affected include Maine landowners and mill owners, Maine woods workers and mill workers; communities in the spruce-fir region, and Canadian mill owners and woods workers dependent on the Maine spruce-fir resource. The spruce-fir forest contains a large acreage of old stands, and a deficiency of younger age classes. Because of this imbalanced age structure, spruce-fir inventories will continue to decline over the long term even if protected from spruce budworm. Inventories would decline at a more rapid rate if not protected. Social attitudes toward spruce budworm control vary greatly. Some landowners want to have their land protected against spruce budworm using chemical insecticides, whereas others do not. A recent poll of Maine residents indicates that a majority prefer an IPM approach to spruce budworm management. However, the same poll indicates that one-fourth of Maine residents do not support use of chemical insecticides against spruce budworm. Two Indian Tribes in Maine have been opposed to use of chemical insecticides for spruce budworm suppression.

Spruce Budworm Management Methods

Four kinds of spruce budworm management methods were considered in developing alternatives: chemical, biological, silvicultural and utilization-marketing methods.

Chemical methods involve aerial application of one or more insecticide products registered by the U.S. Environmental Protection Agency. Final decisions on insecticides to be used and specific sites to be treated would be made annually as part of a site specific environmental assessment.

Chemical methods would provide short term gains by keeping trees alive, and potential long term gains by allowing more time for orderly application of silvicultural and utilization-marketing methods. Chemical methods would also provide time for salvage or other harvesting of spruce-fir stands not being protected with insecticides. Some areas would be treated with chemical insecticides more than once during a 5-year program. Populations of some non-target invertebrate species may be reduced for various time periods depending on the chemical used. Other effects of chemical methods include insecticide drift, aircraft

noise around some airports during insecticide application, energy consumption, and insecticide residues in soil and water. Cost of chemical insecticide application (Sevin 4 Oil) in 1980 was $4.65 per acre.

Biological methods would consist of aerial application of one or more registered formulations of Bacillus thuringiensis (Bt). Final decisions on Bt formulations to be used and specific sites to be treated would also be made annually as part of a site specific environmental assessment.

Bt has not been as effective in protecting trees as chemical insecticides, particularly in areas with high budworm populations, but should keep most trees alive. Bt would temporarily reduce populations of some non-target moth and butterfly species. Bt application in 1980 cost $12.50 per acre.

Silvicultural methods would principally involve application of methods to reduce fir as a component of existing and future stands. Silvicultural methods would also involve use of salvage and other harvesting in areas not protected by insecticides. The Maine Bureau of Forestry in cooperation with large landowners would seek to increase application of silvicultural methods during a 5-year program. Several large landowners have indicated commitments to apply silvicultural methods and have increased their staffs responsible for spruce budworm management. These landowners have indicated commitments to plant less susceptible species, discriminate against fir in harvesting operations, and apply precommercial thinning to further reduce the fir component of young stands.

Silvicultural methods would not significantly alter the course of the current outbreak, but could reduce losses on the limited acreage treated. Only a relatively small acreage could be treated with silvicultural methods during a 5-year program. Salvage cuts would reduce losses in areas not protected with insecticides.

Gains from silvicultural methods are primarily long term. Unless continued for many years in conjunction with chemical or biological methods there would be little overall effect from silvicultural methods. Silvicultural methods if applied over the long term could reduce the impact of any succeeding spruce budworm outbreak.

Utilization-marketing methods would involve increased use of fir in the short term and decreased use of fir in the long term; use of dead fir and smaller fir; and development of new markets to use greater quantities of live and dead fir that would not otherwise be used. Silvicultural and utilization-marketing methods are strongly interdependent. To a large extent, one of these methods cannot be applied without the other.

Utilization-marketing methods also would not alter the course of the current outbreak, but might reduce its impact to a limited extent through short term increased use of fir. Gains from utilization-marketing would be significant only if these methods were continued in the future.

Alternative 5-Year Programs

Five alternatives were considered. All of the alternatives except no action would involve increased use of silvicultural and utilization-marketing methods. Alternative 1 would maintain use of chemical methods at the same level as in the previous 5 years whereas the other alternatives would involve decreases in use of chemical methods. Alternatives 3 and 4 would involve increases in use of biologicals.

The alternatives considered were as follows:

Alternative 1 would involve use of all spruce budworm management methods on 8 million acres vulnerable to the spruce budworm. About 5 million of these acres are expected to be in high or extreme hazard conditions over the next 5 years. Chemical and biological insecticides would be used to protect these 5 million acres. Insecticides would be applied annually on a total of about 1.9 million acres (chemicals 1.8 million; Bt 100,000). Protection would allow orderly increases in silvicultural and utilization-marketing methods, but might also lead to over-dependence on insecticides and reluctance by some landowners to invest in other methods. About 3 million acres of the 8 are not imminently threatened by the spruce budworm and would not be protected with insecticides. Protected areas would be preserved to help fill a spruce-fir supply shortfall expected in 20 to 30 years. Risk of tree mortality and potential disruption of silvicultural and utilization-marketing methods would be minimized in areas protected with insecticides. Under this alternative the need for salvage would be minimal. Expected short and long term effects of insecticides on populations of some non-target organisms would not differ from that of the past 5 years.

Alternative 2 would involve use of all spruce budworm management methods on 8 million acres. About 5 million of these acres are expected to be in high or extreme hazard condition over the next 5 years. Chemical and biological insecticides would be used to protect an estimated 3 million acres in areas of high or extreme hazard. Insecticides would be applied annually on a total of about 1.4 million acres (chemicals 1.3 million; Bt 100,000). Protection would allow orderly increases in silvicultural and utilization-marketing methods. About 2 million acres in high or extreme hazard conditions would not be protected with insecticides. Salvage and other harvesting would be concentrated on these unprotected areas. Protected areas would be preserved to help fill a spruce-fir supply shortfall expected in 20 to 30 years. Some stands would be removed from protection over the 5 years including stands with the least volume of fir and stands on the least productive sites. Expected short and long term effects of insecticides on populations of some non-target organisms would be less than that of the past 5 years. Tree mortality would increase in areas not protected by insecticides. Much of this mortality would be salvaged.

Alternative 3 would involve use of all spruce budworm management methods on 8 million acres. About 5 million of these acres are expected to be in high or extreme hazard condition over the next 5 years. Chemical and biological insecticides would be used to protect an estimated 3

million acres in high or extreme hazard condition. Insecticides would be applied annually on a total of about 1.1 million acres (chemicals 950,000; Bt 150,000). Protection would allow orderly increases in silvicultural and utilization-marketing methods. About 2 million acres in high or extreme hazard condition would not be protected with insecticides. Salvage and other harvesting would be increased and concentrated on these unprotected areas. Protected areas would be preserved to help fill a spruce-fir supply shortfall expected in 20 to 30 years. Planning of spray blocks would be intensified based on refined biological evaluations and resource surveys. This would allow more precise application and a reduction in the amount of insecticide used while still protecting 3 million acres of spruce-fir. Some stands would not be protected including stands with the least volume of fir and stands on the least productive sites. Expected short and long term effects of insecticides on populations of some non-target organisms would be much less than that of the past 5 years. Tree mortality would increase in areas not protected by insecticides. Much of this mortality would be salvaged.

Alternative 4 would eliminate the use of chemical insecticides and rely on biologicals to meet protection needs on 1 million acres in high or extreme hazard condition. Bt would be applied to about 500,000 acres each year. Identification of stands for protection would become critical. Precise spruce budworm population data would be required over large areas to plan Bt use. Thus biological evaluations and precision of insecticide application would have to be greatly increased. Bt might not provide the same level of protection expected with chemicals, but should keep most trees alive in areas treated. Many areas of spruce-fir would not be protected and increased mortality would occur on these areas. Much of the dead wood could not be salvaged. After 5 years of no protection, the condition of most stands would be too serious to allow recovery even if insecticide use were resumed. Use of silvicultural and utilization-marketing methods would probably be disrupted to a major extent as salvage and other harvesting operations increased on unprotected areas. Spruce-fir supply would not be affected during the next 5 years. However, 1 million acres would not be sufficient to supply mills at current levels in the long term. Harvest could continue for a few years on unprotected areas, but since heavy mortality would occur in these areas, harvest might not provide adequate wood supplies in the long term. Some loss of employment could occur as wood supply declined in the long term. Expected short term effects of Bt on populations of non-target butterfly and moth species would increase over the past 5 years. Other non-target insect groups would not be affected.

Alternative 5, no action, would make no provision for spruce budworm management, except salvage, other harvesting, and utilization of dead, dying, and threatened spruce-fir. It would lead to extensive tree mortality on 5 million acres. Harvest of dead and surviving spruce-fir could continue for a few years. In addition, hardwood species could be used to offset some of the losses of spruce-fir. Application of silvicultural and utilization-marketing methods would be disrupted to a major extent as the forest deteriorated in the long term, and as emphasis was shifted to salvage. Effects of insecticides on populations of non-target organisms would not occur. After 5 years of no protection,

existing stands would be too serious to permit recovery even if insecticide use were resumed. An expected supply shortfall in 10 to 20 years could lead to loss of some employment.

Evaluation Criteria

The alternatives were evaluated against the following criteria:

(1) Minimizes spruce budworm caused balsam fir and spruce mortality.
(2) Provides flexibility to meet changes in resource management objectives and techniques.
(3) Minimizes potential public concern about use of chemical insecticides.
(4) Reduces impacts on non-target organisms.
(5) Reduces chemical insecticide contamination of water and non-target land areas.
(6) Encourages long term development of a forest less susceptible to spruce budworm damage.
(7) Minimizes potential for long term disruption of Maine's forest economy.
(8) Compatible with the objectives of State and Federal laws and policy.

Alternative 3 best satisfies the evaluation criteria.

Alternative 5-Year Program Selected by USDA Forest Service

The alternative 5-year program selected by the USDA Forest Service is alternative 3, IPM involving an increase in silviculture and utilization-marketing, while the use of chemicals is reduced and the use of biologicals is increased.

This selected program should provide additional time for landowners and mill owners to further assess and apply silvicultural and utilization-marketing methods. The selected alternative should also help landowners maintain their spruce-fir inventories over the 5-year period.

The level of insecticide use proposed under the selected alternative would require intensification of biological and resource surveys to more precisely identify stands requiring protection, and would also require more precise insecticide application. Significant progress that has already been made and expected further intensification of survey and planning activities by the State and landowners is expected to make this possible.

Demonstrated progress in implementing IPM over the 5-year program would probably be essential in ensuring general public support for the program.

Responsibility for implementation of the proposed 5-year program would be shared by the Maine Bureau of Forestry, forest landowners and mill owners. The magnitude of the spruce budworm infestation,

intermingled ownerships affected, and potential for international and regional impacts suggest that a Federal role exists in the proposed IPM program.

If implemented, the selected alternative would guide USDA Forest Service consideration of requests for Federal financial assistance that may be received annually from the Maine Bureau of Forestry during the next 5 years. Annual requests would be considered on an individual basis. Decisions concerning financial assistance would be made annually after completion of a site specific environmental assessment carried out in accordance with the National Environmental Policy Act. Each environmental assessment would consider USDA Forest Service biological, environmental, economic, and Federal role criteria in reaching a decision on Federal financial assistance.

At the end of 5 years the proposed program would be re-evaluated. If at any time during the 5 years substantive new information becomes available the need to re-evaluate the program under the NEPA process would be considered.

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INTRODUCTION

The Maine Department of Conservation, Bureau of Forestry, has proposed a 5-year (1981-1985) Integrated Pest Management (IPM) program for the spruce budworm and has indicated that USDA Forest Service financial assistance may be requested annually for major portions of the program (Appendix O). The 5 year program was proposed in response to the continuing long term threat of spruce budworm to the Maine spruce-fir resource. The President's 1979 Environmental Message to Congress described IPM as "a systems approach to reduce pest damage to tolerable levels through a variety of techniques, including predators and parasites, genetically resistant hosts, natural environmental modifications, and when necessary and appropriate, chemical pesticides". In response to the Maine Bureau of Forestry's request, the USDA Forest Service as required by the National Environmental Policy Act of 1969, carried out the environmental analysis documented in this Final Programmatic Environmental Impact Statement (FPEIS).

The current spruce budworm infestation extends over much of northern Maine and eastern Canada (Figure 1). High to extreme spruce budworm hazard conditions have existed on about 5 million acres of Maine's 8 million acre spruce-fir forest for the past several years. Because of the vast acreage of forest susceptible to the spruce budworm, and continuing high populations, the epidemic is expected to continue for the forseeable future.

The proposed IPM program would be applied to the 8 million acre Maine spruce-fir forest since all of this resource is susceptible to the spruce budworm. Since the spruce-fir type is broken these acres are scattered over a much larger area referred to as the Spruce-Fir Protection District (Figure 1). This District was established by State law for administration of a spruce budworm management program including landowner taxation to support the program. In October 1981 when the State's new Spruce Budworm Management Act (Appendix I) goes into effect this area will no longer be referred to as the Spruce-Fir Protection District. However most IPM program activities would continue to be directed to spruce-fir stands within the area now referred to as the Spruce-Fir Protection District.

Major issues, concerns and opportunities identified during the scoping phase of the environmental analysis were as follows: the potential threat of spruce budworm to the State's economy; need to initiate a long term management program to replace the past short term approach; concern that a long term IPM program might not be significantly different from the past approach; need for continued reliance on insecticides as a major part of any IPM program; concern that long term undetected adverse effects may occur in humans exposed to insecticides; insecticide application problems such as drift and pilot safety; possible adverse effects of spruce budworm impact on small non-industrial lands; and extent to which the general public may benefit from possible Federal financial assistance for spruce budworm management.

From 1972 through 1979, almost $35 million were spent for spruce budworm suppression in Maine. The Federal government contributed 42 percent of this amount, the State government contributed 7 percent, and the forest landowners contributed 51 percent (Table 1). In 1980,

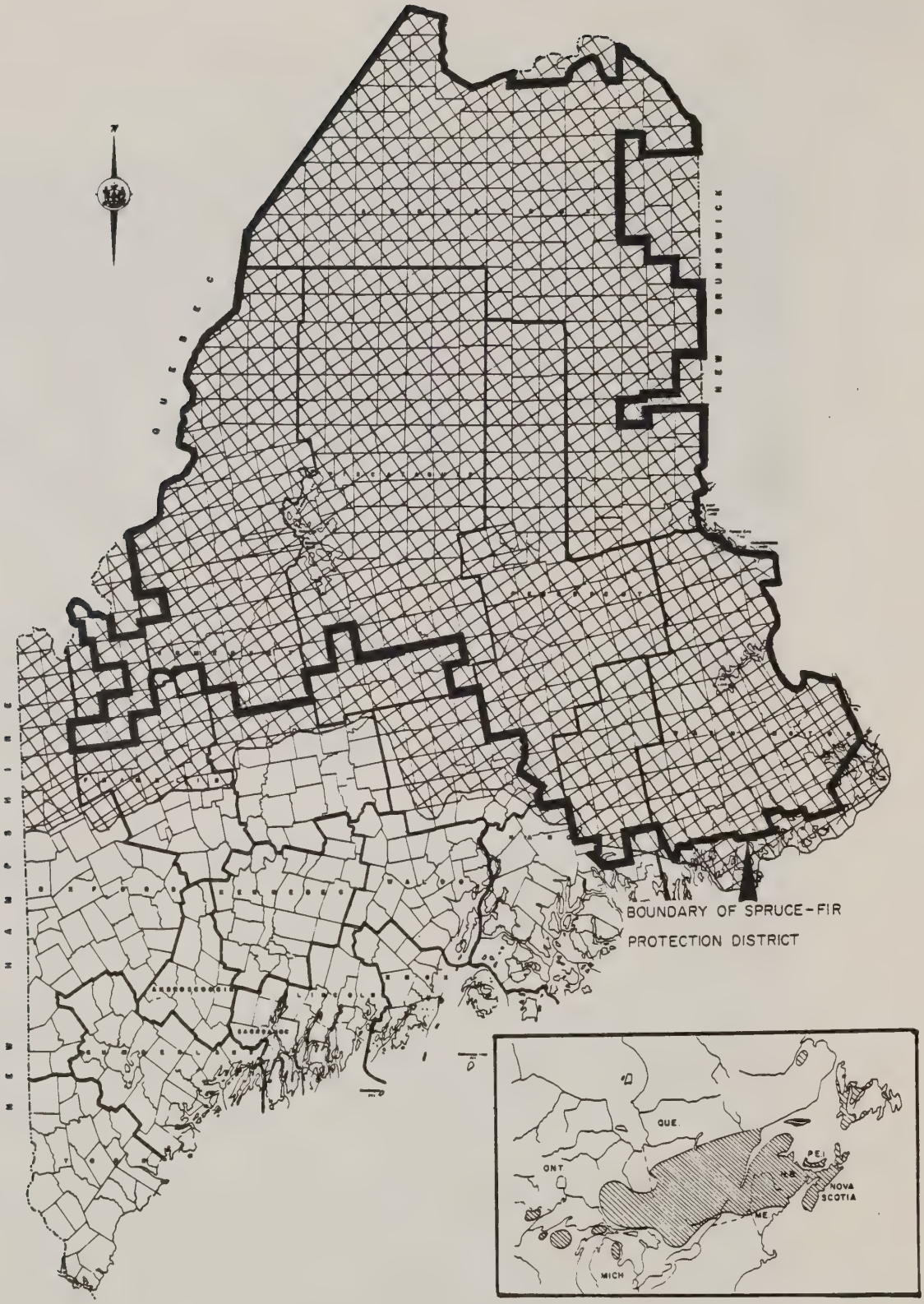


Figure 1. Current spruce budworm infestation (cross-hatched area) in northern Maine and location in relationship to the total outbreak which extends over much of eastern Canada (Inset). Source: Maine Bureau of Forestry, 1980.

about $4.8 million was spent on chemical insecticide suppression in Maine. Forest landowners contributed all of the funds needed for chemical suppression in 1980. The USDA Forest Service did not contribute funds for the State's spruce budworm chemical insecticide suppression project in 1980, but did continue to fund research and application projects including a 200,000 acre demonstration of the biological insecticide, Bacillus thuringiensis (Bt) (Table 2). Areas where insecticides were applied from 1972 through 1980 are shown in Figures 2, 3, and 4.

Table 1 - Acres sprayed and spraying costs, spruce budworm suppression projects, 1972-1980.

Year	Thousand acres sprayed	Project cost M$	Private cost M$	State cost M$	Federal cost M$
1972	500	1,310	386	386	538
1973	450	1,178	360	229	589
1974	430	1,006	360	143	503
1975	2,233	6,214	2,361	746	3,107
1976	3,500	8,527	3,965	298	4,263
1977	921	2,960	1,855	77	1,087
1978	1,138	3,697	2,274	92	1,331
1979	2,791	11,000	6,600	400	4,000
1980 1/	1,013	4,815	4,815	0	0
TOTAL	12,976	39,806	22,975	2,371	15,418

1/ Data for 1980 do not include a 200,000 acre demonstration project of the biological Bt.

Table 2 - Summary of past aerial spraying for spruce budworm suppression in Maine.

Year	Insecticide	Thousand acres treated
1954	DDT	21
1958	DDT	302
1960	DDT	217
1961	DDT	53
1963	DDT	479
1964	DDT	58
1967	DDT	92
1970	Fenitrothion (Accothion)	210
1972	Mexacarbate (Zectran)	500
1973	Mexacarbate (Zectran)	450
1974	Mexacarbate (Zectran)	430
1975	Carbaryl (Sevin 4 Oil)	496
	Fenitrothion (Sumithion)	1,499
	Mexacarbate (Zectran)	238
1976	Carbaryl (Sevin 4 Oil)	3,460
	Trichlorfon (Dylox 4)	40
1977	Carbaryl (Sevin 4 Oil)	808
	Trichlorfon (Dylox 4)	55
	Acephate (Orthene Forest Spray)	58
1978	Carbaryl (Sevin 4 Oil)	967
	Trichlorfon (Dylox 4)	54
	Acephate (Orthene Forest Spray)	96
	Bacillus thuringiensis (Thuricide 16B)	21
1979	Carbaryl (Sevin 4 Oil)	2,543
	Trichlorfon (Dylox 4)	97
	Acephate (Orthene Forest Spray)	110
	Bacillus thuringiensis (Thuricide 16B, 24, 32, 32B)1/	41
1980	Carbaryl (Sevin 4 Oil)	1,013
	Bacillus thuringiensis 2/	
	Dipel 4L	100
	Thuricide 16B	100

1/ Thuricide 24, 32, and 32B were applied under experimental use permits granted by EPA.
2/ Demonstration Project.

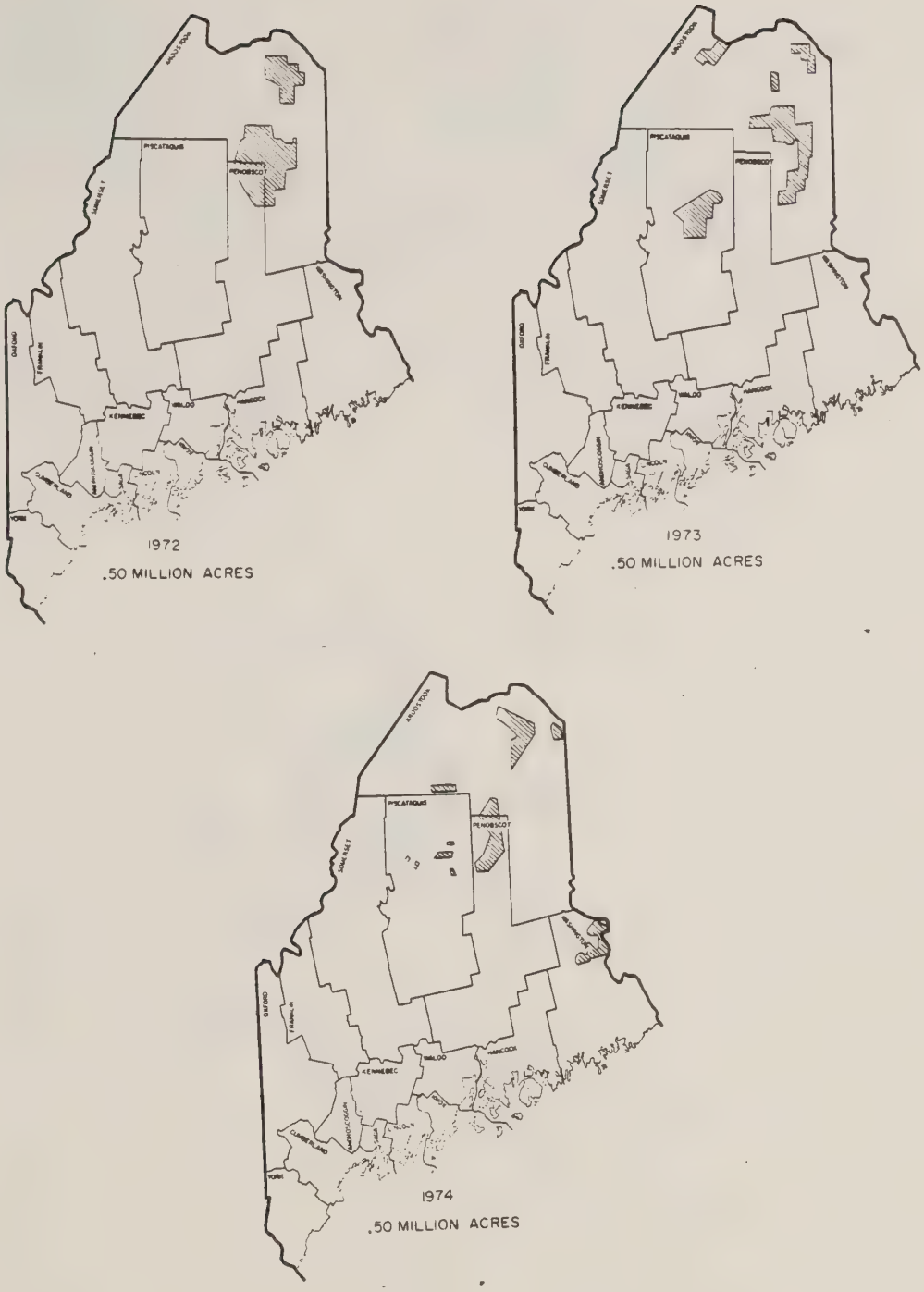


Figure 2. Spruce budworm suppression projects in Maine, 1972-1974.

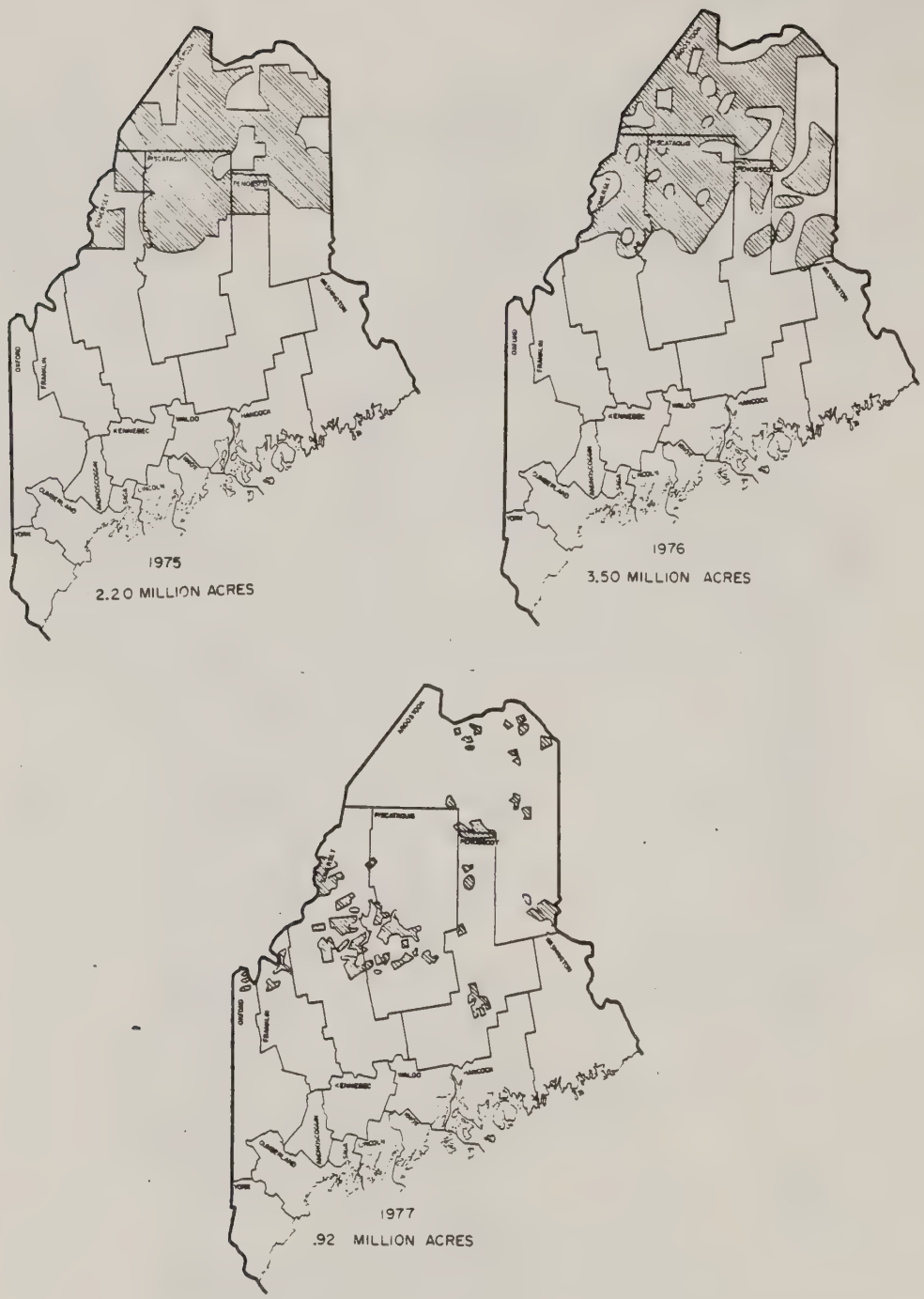


Figure 3. Spruce budworm suppression projects in Maine, 1975-1977.

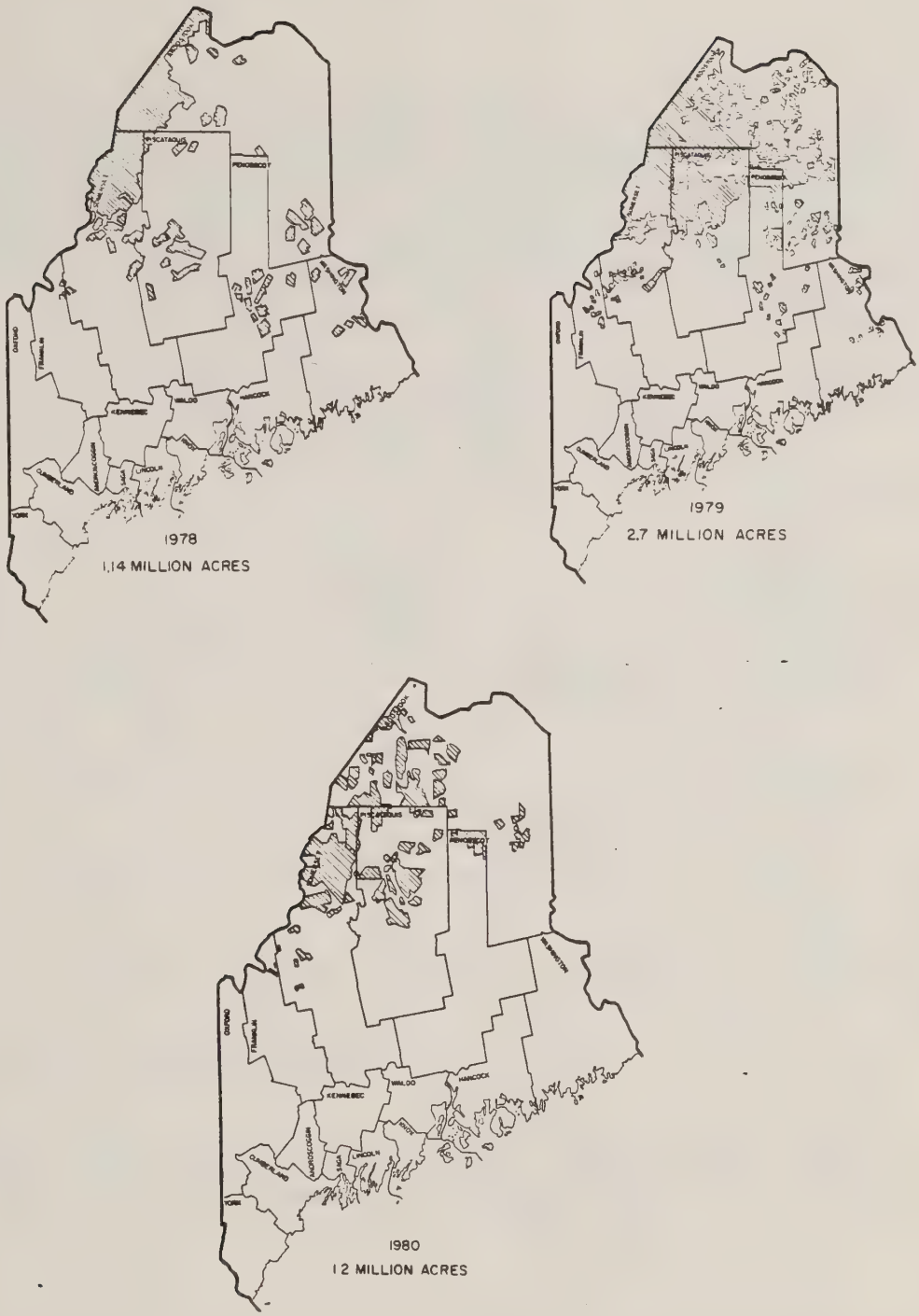


Figure 4. Spruce budworm suppression projects in Maine, 1978-1980.

During the past 5 years (1976 to 1980) about 5 million acres of Maine's spruce-fir resource then in high or extreme hazard conditions were protected by use of chemical or biological insecticides. For the 5 years an average of about 1.9 million acres were treated each year with insecticides. During this period more than half of the same areas were treated more than once. Less than one percent of the area was treated five times, or every year (Table 3).

Table 3 - Acreage treated with chemical and biological insecticides one or more years during spruce budworm suppression projects in Maine, 1976-1980 (source: Maine Bureau of Forestry).

Number years treated	Thousand acres treated	Percent of total acres treated
1	2,095	42
2	1,701	34
3	930	18
4	303	5
5	13	<1
TOTAL	5,042	

Insecticides have been used for spruce budworm suppression in Maine since 1954. Prior to 1970, the objective of suppression was to reduce spruce budworm populations to innocuous levels. This objective was abandoned when use of DDT was discontinued in favor of less persistent insecticides. Since 1970 the primary objective has been to preserve enough foliage to prevent tree mortality until the trees can be harvested. The protection of balsam fir has received highest priority since this species is most vulnerable to mortality.

Since 1975 carbaryl formulated as Sevin 4 Oil® has been the primary insecticide used (Table 2). Carbaryl has been applied most often at a rate of 0.75 pounds active ingredient (a.i.) per acre. Carbaryl has been the preferred insecticide because of its relatively low cost and consistent effectiveness.

Insecticide treatments have generally been successful in forestalling tree mortality. Surveys by the USDA Forest Service, the Maine Bureau of Forestry, and others indicate that spruce-fir mortality in treated areas was 0.3 to 0.4 cords per acre in 1979, while mortality approached 2.5 to 3.5 cords per acre in 1979 in areas not treated with insecticides during the last 3 years. (USDA Forest Service unpublished report; personal communication, Maine Bureau of Forestry).

Application of a 5-year IPM program beginning in 1981 would require close cooperation between the State, private forest landowners and mill owners. Most of the areas considered for an IPM program are in private ownership. About two-thirds of the area is in industrial ownership, while one-third is non-industrial. The chemical and biological insecticide portions of an IPM program would be administered by the Maine Bureau of Forestry. Silvicultural and utilization-marketing portions would be largely the responsibility of private landowners each with their own objectives and constraints which could have a significant effect on the implementation of an IPM program. Several large landowners have indicated commitments to apply silvicultural methods, and have increased their staff responsible for spruce budworm management.

The laws and policies which govern USDA Forest Service participation in spruce budworm management include:

The Cooperative Forestry Assistance Act of 1978 (P.L. 95-313) replaces provisions of the Forest Pest Control Act of 1947. Under this law the Secretary of Agriculture is authorized to protect from insects and diseases, trees and forests on the National Forest System and in cooperation with others on other lands in the United States in order to: (1) enhance the growth and maintenance of trees and forests; (2) promote the stability of forest related industries, and employment associated therewith, through protection of forest resources; (3) aid in forest fire prevention and control; (4) conserve forest cover on watersheds; and (5) protect outdoor recreation opportunities and other forest resources. Subject to certain other provisions of the law the Secretary is authorized to plan, organize, direct, and perform measures he determines necessary to prevent, retard, control, or suppress incipient, potential, threatening, or emergency insect infestations and disease epidemics affecting trees. The Secretary of Agriculture has delegated this responsibility for forest pest management to the Chief of the USDA Forest Service.

The National Environmental Policy Act (NEPA) of 1969 authorizes and directs all Federal agencies to carry out programs in ways that will create and maintain conditions under which man and nature can exist in productive harmony, and fulfill social and economic needs of present and future generations.

A principal mission of the U.S. Department of Agriculture is to assure an adequate supply of high quality food and fiber and a quality environment for the American people. The Department gives special emphasis to the development and use of efficient and environmentally acceptable integrated pest management systems.

USDA Forest Service policy encourages the protection and preservation of the forest resources of the Nation against destructive forest insects and diseases. Forest pest population outbreaks are to be prevented or suppressed by methods that will restore, maintain, or enhance the quality of the environment. Forest resource protection objectives are attained

on non-Federal lands through cooperation with the State officials responsible for forest protection. Programs approved for cooperative financing must meet USDA Forest Service standards of biological, economic and environmental acceptability examined during the NEPA process.

Although the Cooperative Forestry Assistance Act of 1978 authorizes Federal assistance, certain criteria must be met to establish a Federal role. These criteria include potential for international consequences, and extent of national or regional economic impacts. The nature and extent of the Federal role must be reviewed under the NEPA process and thus is exposed to public involvement and comment.

Maine Bureau of Forestry participation in spruce budworm management is governed by State legislation (Appendices H and I). A new State law is expected to lead to significant changes in spruce budworm management. The 109th Maine Legislature early in 1979 mandated that the Commissioner of the Department of Conservation present by January 1, 1980 his recommendations -- including draft legislation to implement them -- for future spruce budworm policy in Maine. In 1979,the Commissioner formed a Budworm Policy Review Committee, composed of both professionals and lay people, to assist the Department of Conservation in this policy review. The Commissioner considered the results of the Committee's work and submitted his recommendations. His recommendations were subsequently incorporated into a law passed by the Legislature in 1980 (Appendix I). As enacted, this law initiates a number of significant changes in Maine's spruce budworm management program:

(1) funding of a spruce-fir supply-demand analysis;

(2) initiation of a voluntary spray program, starting in 1982;

(3) establishment of a Settlement Region Corridor along all publicly maintained roads with provision that municipalities can restrict spraying within this Corridor.

(4) implementation of a new tax system to raise funds for the insecticide application projects based entirely on acres actually sprayed in a given year;

(5) initiation of General Fund support for ongoing integrated pest management activities, other than insecticides;

(6) continued administration of spruce budworm insecticide application projects by the Maine Bureau of Forestry; and

(7) provision that the Maine Pesticide Control Board will be responsible for prior review of spruce budworm insecticide application projects for environmental and human health impacts.

In addition, as of October, 1981 under this new law the State will request from each landowner, as a requirement for spray program participation, a 5-year cutting plan and other management information necessary for spray project and management program planning.

Research and application projects administered by the USDA Forest Service contribute to spruce budworm management programs in Maine. The Canada-United States Spruce Budworms Program (CANUSA) sponsors research and development activities in Federal, state, industrial, and university sectors. In Maine, two CANUSA demonstration projects which began in 1979 seek to demonstrate integrated approaches to the spruce budworm problem. These demonstration projects are evaluating a wide range of options for spruce budworm management: silvicultural practices which minimize the fir component of existing stands; methods to encourage spruce over fir in regeneration; and use of detailed type mapping and stand risk analysis for better management decisions and better planning of insecticide use. One of these demonstration projects is being carried out in cooperation with the University of Maine. Landowners who are cooperating in the project include Great Northern Paper Company, Seven Islands Land Company and the State of Maine, Baxter Park Authority. The other demonstration project is being conducted in cooperation with the International Paper Company. CANUSA projects are also underway in Maine and elsewhere to develop and evaluate technology dealing with environmental monitoring, chemicals which modify insect behavior, Bt, insect growth regulators, spruce budworm biology, spray technology, integrated pest managment, sampling, timber utilization, fungal insecticides, viral insecticides, forest type mapping, forest biology, silviculture, harvesting and presalvage, mortality and growth impact, and hazard indices. New technology developed over the next 5 years may be incorporated into the proposed IPM program.

A survey of Maine's forest resource is currently being conducted by the Northeastern Forest Experiment Station, USDA Forest Service in cooperation with the State. The survey will provide new information on the status of Maine's spruce-fir wood supply.

AFFECTED ENVIRONMENT

A large number of biological, physical, economic, and social factors are potentially affected by alternative IPM programs. These factors are discussed below.

BIOLOGICAL FACTORS

Spruce Budworm

The spruce budworm, Choristoneura fumiferana (Clem.), is a native of the spruce-fir forests of eastern North America. The larval stage feeds on spruce and fir foliage during May and June. At high population levels, as in Maine, the budworm is especially destructive to balsam fir and in some cases can severely damage or kill spruce.

Past budworm outbreaks have caused extensive tree mortality in the spruce-fir forests of the United States and Canada. Studies backdating tree growth in Maine, New Brunswick, and Quebec indicate that five major outbreaks occurred between 1704 and 1947. Each had a duration of 5 to 11 years. The intervals between outbreaks were irregular - shortest 24 years and longest 76 years (Blais 1965). Spruce-fir forests regenerate after budworm outbreaks. In accord with this natural pattern, the existing spruce-fir forests of Maine have regrown to maturity since the 1910 to 1919 outbreak and are generally in a state of high susceptibility to budworm.

The end of the present spruce budworm outbreak cannot be predicted. The current Maine spruce-fir forest is particularly favorable to spruce budworm, and this forest has been largely protected by insecticides. Under these conditions the present outbreak could continue for several years. Thus far, natural control factors have not significantly affected the outbreak.

Spruce-Fir Forest

The spruce-fir forest type covers about 8 million acres or 47 percent of the forest land area in Maine (Ferguson and Kingsley, 1972). Red spruce (Picea rubens Sarg.), white spruce (P. glauca (Moench) Voss) and black spruce (P. mariana (Mill.) B.S.P.) and balsam fir (Abies balsamea (L.) Mill.) make up this type. Of the total spruce-fir volume in northern Maine, about half is spruce and half is balsam fir. Other tree species frequently intermixed with spruce and fir include eastern white pine (Pinus strobus L.), hemlock (Tsuga canadensis (L.) Carr.), tamarack (Larix laricina (DuRoi) K. Koch), beech (Fagus grandifolia Ehrh.), birch (Betula spp.), maple (Acer spp.), and aspen (Populus spp.).

Of the total softwood inventory volume in Maine, about 80 percent is spruce-fir (Ferguson and Kingsley 1972). Spruce-fir makes up 71 percent of the softwood growing stock and 51 percent of the total growing stock on commercial forest acreage. Sixty-eight percent of the spruce-

fir growing stock is located in the four northernmost counties, Aroostook, Penobscot, Piscataquis, and Somerset.

In 1978 and 1979, the USDA Forest Service, Northeastern Forest Experiment Station at Orono, Maine, summarized resource data supplied by Maine landowners representing approximately 8 million acres of the State's Spruce-Fir Protection District (personal communication, Gordon Mott). The summary shows that, for the acreage represented, 24 percent is softwood (stand composition greater than 75 percent softwood); 26 percent is mixed wood (stand composition is 25 to 75 percent softwood); 21 percent is non-host type, 6 percent is wetlands, 5 percent is water; and 18 percent is other (agricultural, residential, etc.). The distribution of softwood and mixed wood acreage is shown in Figure 5.

Human Population

The distribution of permanent residents in Maine's Spruce-Fir Protection District is shown in Figure 6, and the distribution of seasonal dwellings scattered throughout the District in Figure 7.

In addition to permanent and seasonal residents, there are many visitors to the spruce-fir forest of Maine. These visitors include campers, fishermen, and canoeists. Most of the recreational use is concentrated around water or in parks. The Maine Bureau of Forestry estimates that 100,000 people annually visit areas within the Spruce-Fir Protection District during May and June, the time when insecticides may be applied.

Logging crews are also present in the spruce-fir forest. The Maine Bureau of Forestry estimates that 2,000 woods workers are involved annually in harvesting operations within the Spruce-Fir Protection District during May and June.

Fish and Wildlife

The number of known species of fish, mammals, reptiles, birds and amphibians in Maine's Spruce-Fir Protection District are as follows:1/ Fish - 55, Mammals - 36, Reptiles - 19, Amphibians - 18, Birds - 218. No fish or wildlife species in Maine are currently designated by the Federal government as threatened.

One of four species currently listed as endangered under the Endangered Species Act of 1973 occurs in Maine and three others may possibly occur in Maine. The bald eagle, (Haliaeetus leucocephalus L.), is known to occur in Maine. Eastern cougar, (Felis concolor cougar Kerr.), American peregrine falcon, (Falco peregrinus anatum Turnstall), and the arctic subspecies of peregrine falcon (Falco peregrinus tundrius White) may possibly occur in Maine. Locations of nesting sites of the bald eagle are known and protected. The American peregrine falcon has not nested in Maine since the 1960's and has been observed only

1/ The number of bird species is taken from a list compiled by B.G. Fell and A.A. Barden, Jr. prepared in 1973 and revised in 1977 by R. C. Eckhart. Unpubl. Department of Zoology, University of Maine, Orono. Other information from list by A.A. Barden, Jr. and J.D. McCleave, Unpubl. Department of Zoology, University of Maine, Orono.

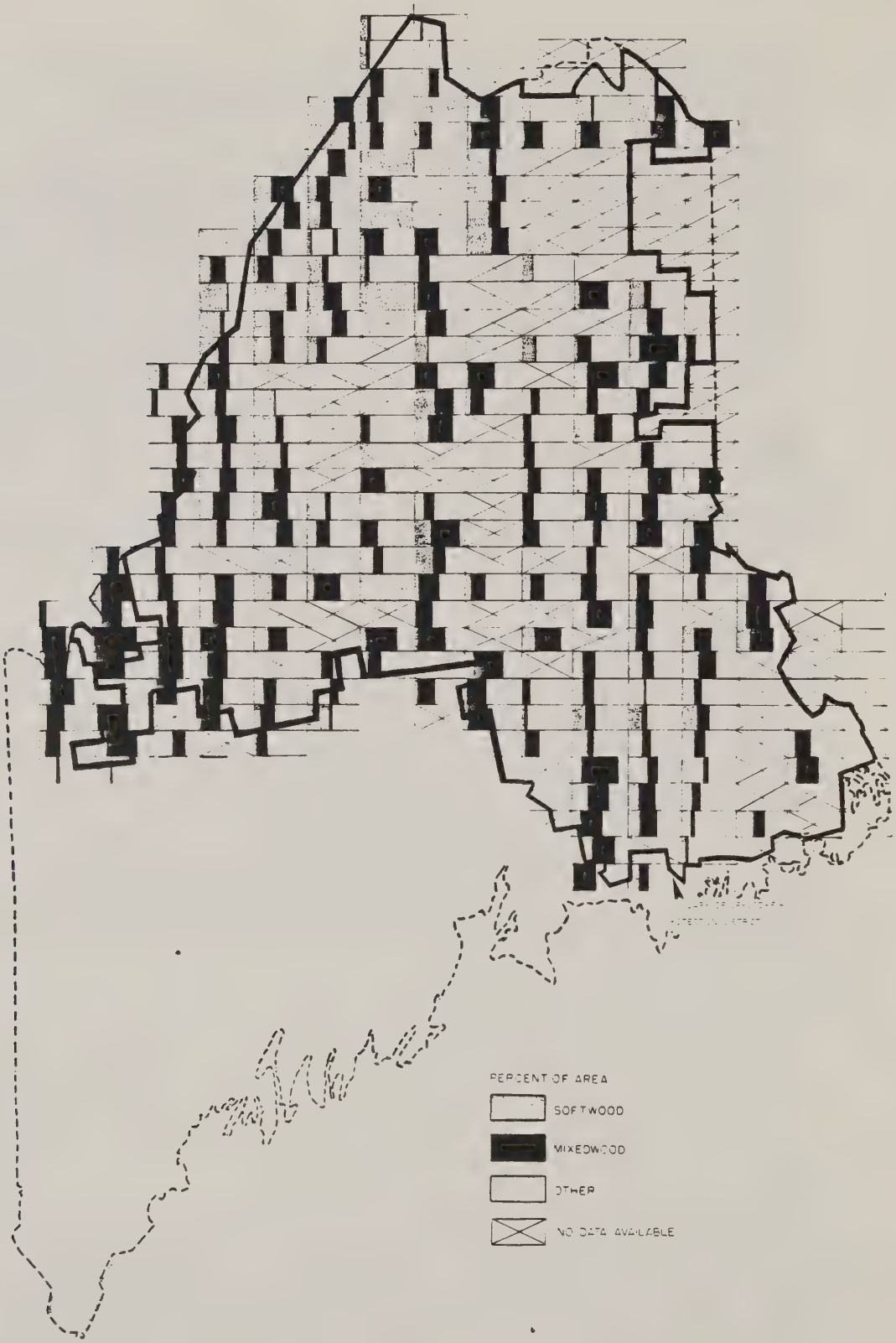


Figure 5. Proportions of softwood and mixed wood type in Maine's Spruce-Fir Protection District. Proportions shown by 2 township blocks. Source: Map prepared by USDA Forest Service, Northeastern Area, State and Private Forestry based on data compiled by USDA Forest Service Northeastern Forest Experiment Station, Orono, Maine, 1979.

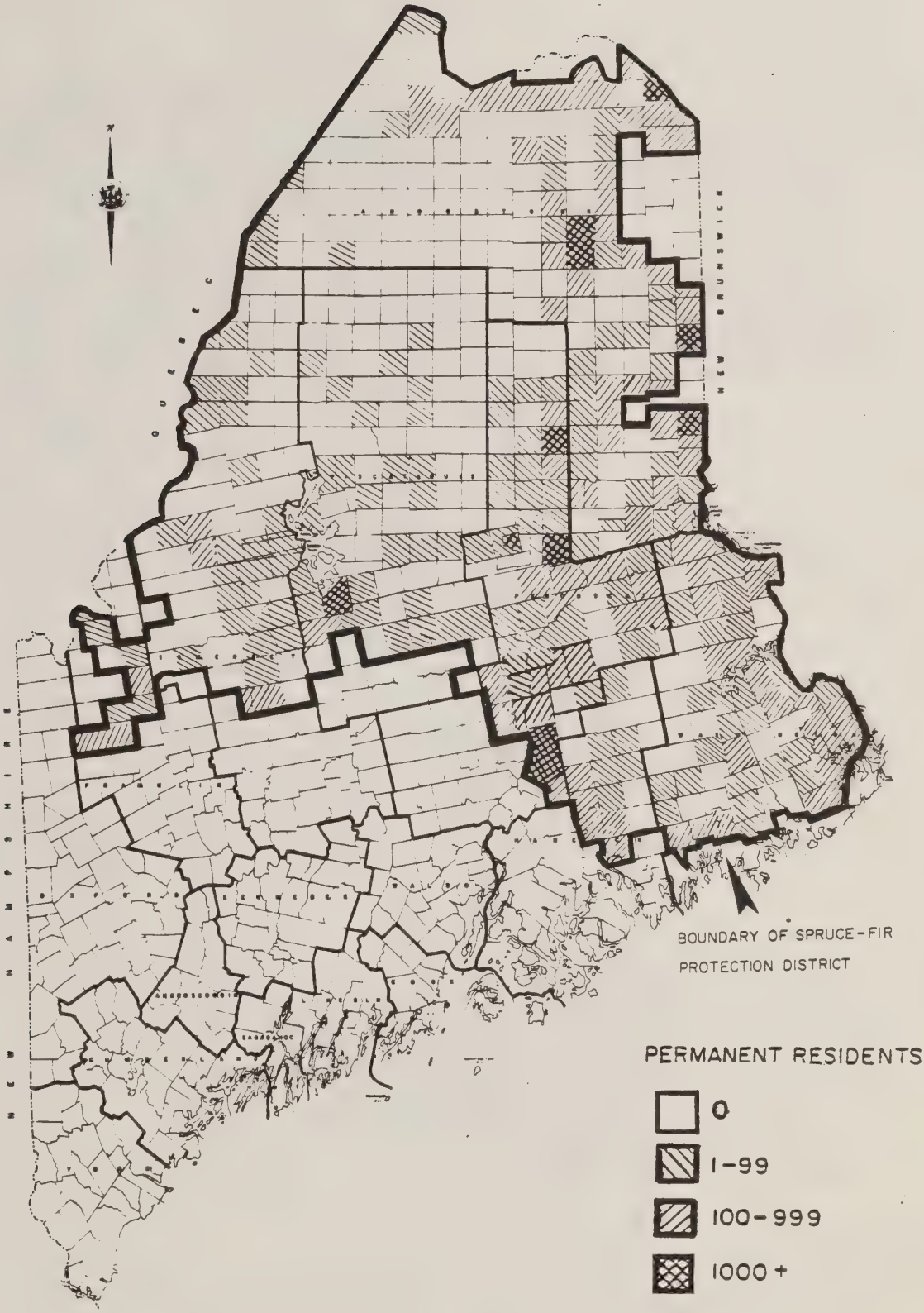


Figure 6. Distribution of permanent residents by township within Spruce-Fir Protection District. Source: Maine Bureau of Forestry, 1979.

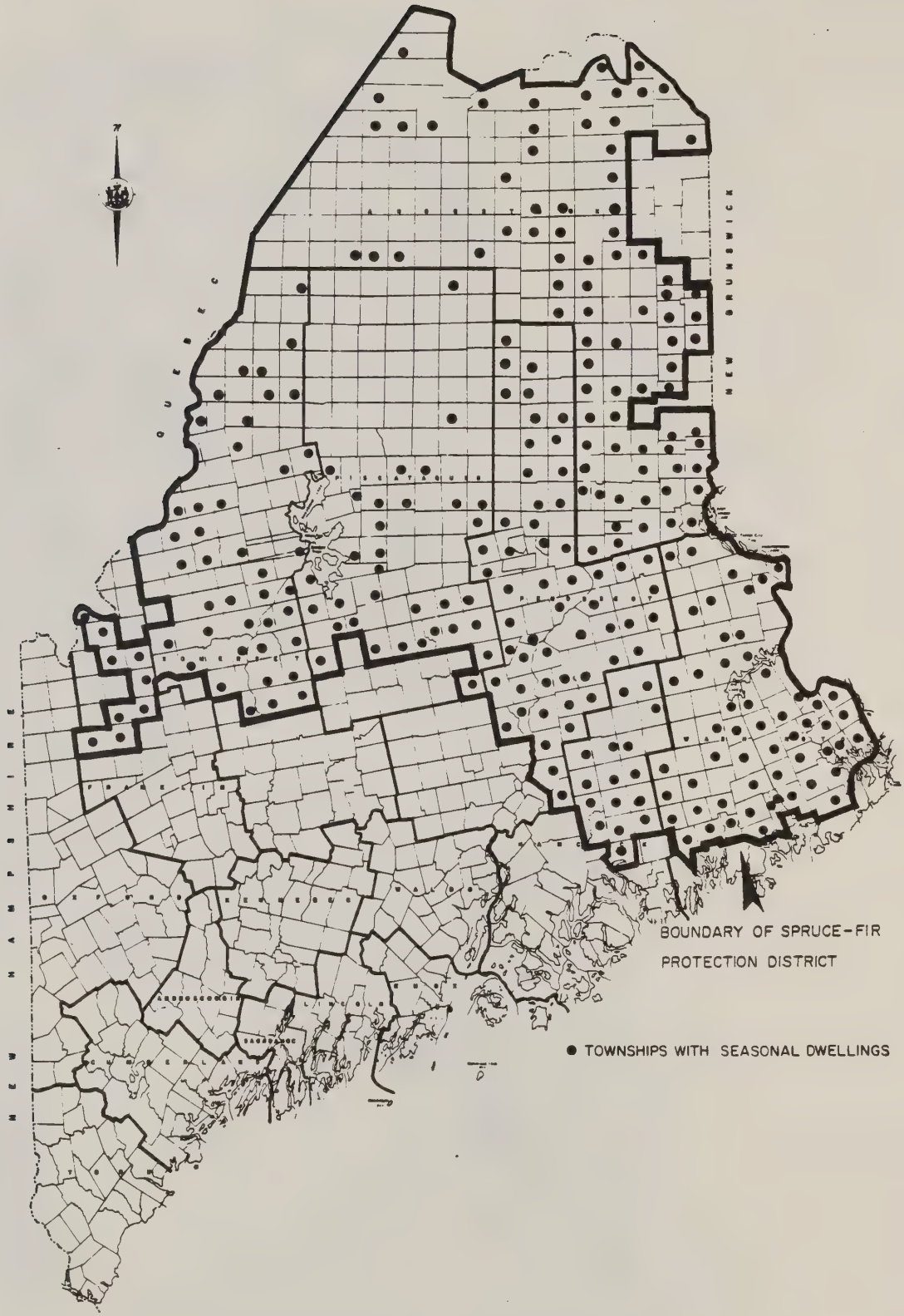


Figure 7. Distribution of seasonal dwellings within Spruce-Fir Protection District. Source: Maine Bureau of Forestry, 1979.

occasionally since; the arctic peregrine falcon migrates in May passing along the Maine coast; and the Eastern cougar probably is not found in the State (personal communication, University of Maine, Farmington, Department of Zoology, and Maine Department of Inland Fisheries and Wildlife).

Two rare forms of the Arctic char (Salvelinus alpinus), the Blueblack and Sunapee, are found within the Maine Spruce-Fir Protection District. The blueback char is found in only 10 lakes or ponds and the Sunapee char occurs naturally only in one pond and has been introduced in nine others.

Other Non-Target Organisms

Other non-target organisms occurring in the spruce-fir forest include: terrestrial and aquatic invertebrates; pollinators, including bees needed in blueberry (Vaccinium spp.) production and honey production; spruce budworm parasites and predators; and soil organisms.

In May and June of each year, blueberry growers in Washington County import about 2,500 bee hives (50,000 bees per hive) from out of state for use in pollination (Barrett 1979). Lying within the Spruce-Fir Protection District, blueberry production areas cover an estimated 32,000 acres in Washington County (personal communication, Soil Conservation Service, Machias, Maine) and 20,000 acres in Hancock County (personal communication, Soil Conservation Service, Ellsworth, Maine). Blueberry production areas in Washington and Hancock Counties have been mapped (Figures 8 & 9).

PHYSICAL FACTORS

The most distinctive physical features of northern Maine are the mostly flat terrain and the many lakes and streams. The Maine Bureau of Forestry estimates that there are 5,000 lakes, 30,000 ponds and 300,000 miles of streams in the Spruce-Fir Protection District. Fresh water wetlands, (not counting open fresh water) cover about 630,000 acres or about 6 percent of the Spruce-Fir Protection District (personal communication, Maine Bureau of Forestry). Although the topography of most of the Spruce-Fir Protection District is flat or rolling, some areas of midwestern Maine are mountainous.

Annual precipitation in northern Maine averages 36 to 44 inches. Average daily minimum temperatures range from 0° to 12° F in January, from 56° to 58° F in July, average daily maximum temperatures range from 20° to 30° F in January, from 76° to 80° F in July. The average length of the freeze free period is from 120 to 150 days (Lull 1968).

The predominant soils of northern Maine are shallow, very stony or extremely stony loams or sandy loams. The soils are strongly acid and well drained (Lull 1968).

At present fire incidence in northern Maine is low. Sixty to one hundred spot fires occur annually caused primarily by lightning strikes. Dead tops in areas of spruce-fir mortality such as buffer zones may increase fire hazard in the future (personal communication, Maine Bureau of Forestry).

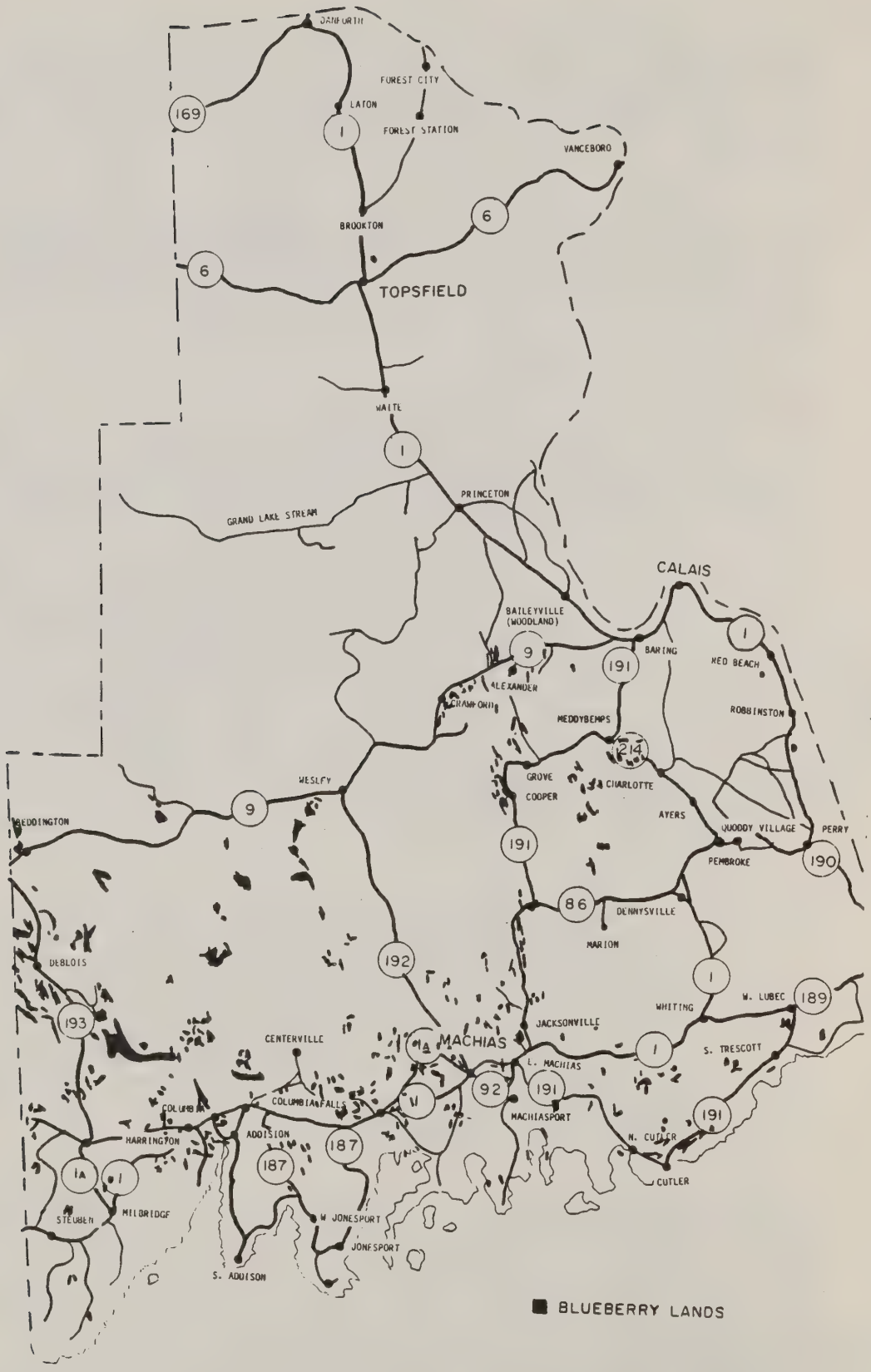


Figure 8. Blueberry production areas in Washington County.
Source: USDA Soil Conservation Service, Machias, Maine, 1979.



Figure 9. Blueberry production areas in Hancock County.
Source: USDA Soil Conservation Service, Ellsworth, Maine 1980.

Twenty-four organic farms in Maine were certified by the Maine Organic Farmer and Gardener Association in 1979. Of these, two are in the Spruce-Fir Protection District (Figure 10). There are other known, but uncertified, organic farms in the District. To be certified, these farms must produce crops without chemical pesticides or fertilizers and farmers must apply to the Maine Organic Farmer and Gardener Association.

ECONOMIC FACTORS

Maine produces more pulpwood than any other State in the Northeast. Of the total softwood pulpwood produced in 14 northeastern states in 1977, 74 percent or 234 million cubic feet was produced in Maine (Nevel and Dickson 1979). Maine currently produces about 3 percent of the softwood pulpwood produced in the United States (USDA Forest Service 1978) and this figure has remained stable over the past several years. The spruce-fir pulpwood produced in Maine is used primarily in the production of high quality paper. It should retain its market position since pulpwood from the South is used primarily in the production of kraft paper. In 1977 as well as 1979, 80 percent of the softwood pulpwood produced in Maine was spruce-fir (Maine Bureau of Forestry 1978, 1980).

In 1979 about 241 million cubic feet of spruce-fir were cut in Maine. This was 53 per cent of the total combined hardwood and softwood volume cut in Maine and 73 percent of the softwood cut in Maine. Of the total spruce-fir cut 42 percent was sawtimber and 58 percent was pulpwood. Of the spruce-fir sawtimber cut, 67 percent was spruce and 33 percent was fir. The ratio of spruce to fir sawtimber cut has remained almost unchanged for the past several years. Of the spruce-fir pulpwood cut in 1979, 43 percent was spruce and 57 percent was balsam fir (Maine Bureau of Forestry 1980). This was the first year in which the amounts of spruce pulpwood and fir pulpwood have been reported separately.

From 1969 to 1979 the volume of spruce-fir sawtimber cut in Maine doubled. During the same period the volume of spruce-fir pulpwood cut remained almost the same due to the increased use of wood residues (Maine Bureau of Forestry 1970, 1980). Total hardwood and softwood cut was similar in 1978 and 1979 but the amount of spruce-fir cut decreased about 3 percent in relation to hardwoods and other softwoods (Maine Bureau of Forestry 1979a, 1980).

The production capacity of Maine's forest products industry, which uses the spruce-fir resource, has been expanding in recent years as reflected in the following figures. Production capacity for Maine's paper mills rose from 2.8 million tons per year in 1975 to 3.4 million tons per year in 1980.1/ Simultaneously, Maine's spruce-fir sawlog production increased from 138 million board feet in 1975 to 360 million board feet in 1979 (Maine Bureau of Forestry 1980).

1/ Maine Paper Industry Information Office quoted in Maine Sunday Telegram, June 28, 1980.

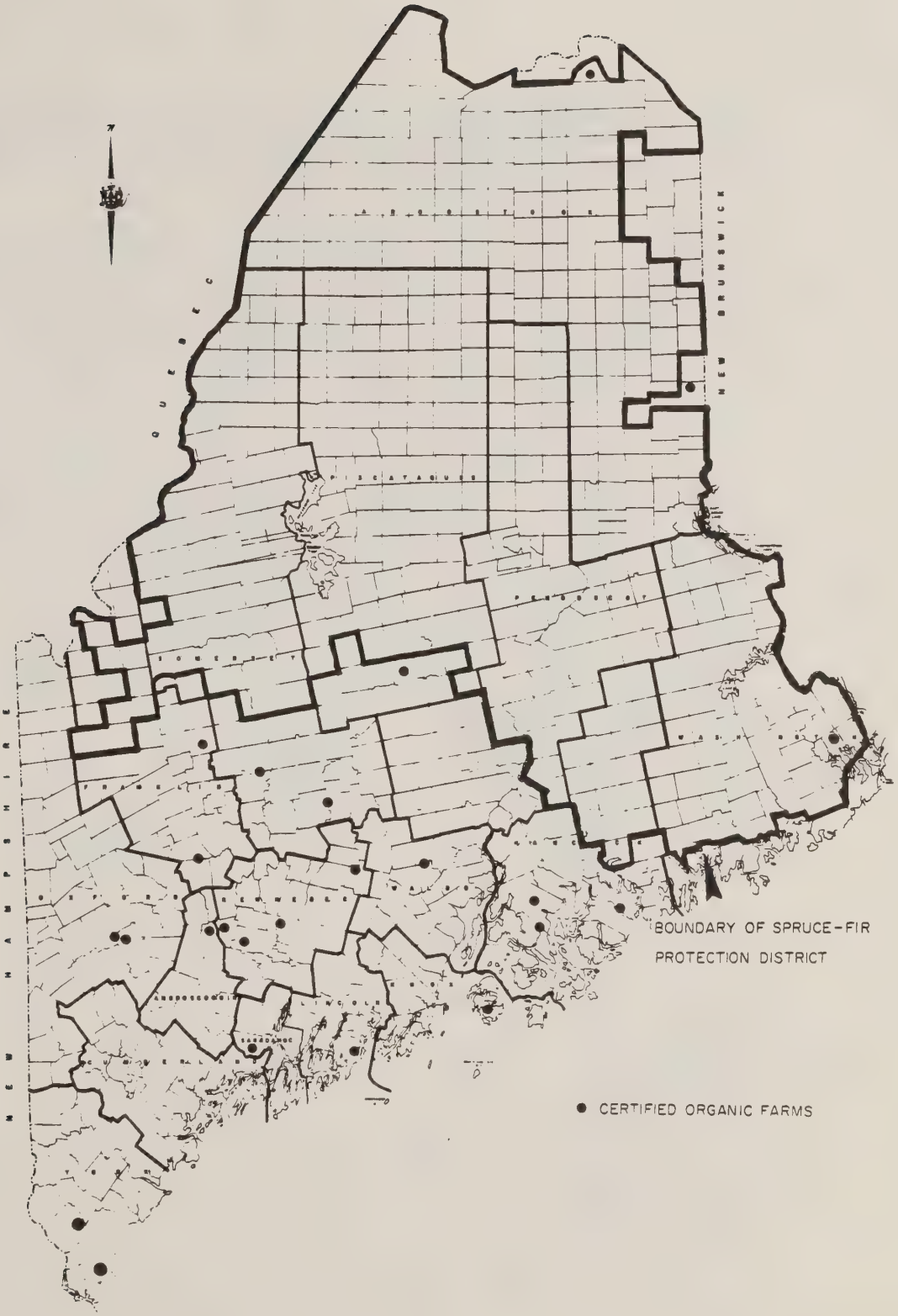


Figure 10. Organic farms in Maine, certified by Maine Organic Farmer and Gardener Association, June 1979. Source: Maine Organic Farmer and Gardener Association.

About 18,000 Maine workers depend on the spruce and fir products industry for employment; the State derives 16 percent of its tax revenue from or through the industry (Chapter 764, Acts of the 1976 Legislature of Maine).

Employment in the entire timber industry in Maine has been steadily decreasing. The U.S. Bureau of the Census (1979) reported a decline from about 35,000 workers to 30,000 workers from 1952 to 1977. This reflected a gain of about 2,000 workers by the paper and allied products industry and a loss of about 7,000 workers by the lumber and wood products industry. The number of jobs per unit of harvest is also declining, due primarily to mechanization. In 1979 15,000 people were employed in the lumber and wood products industry compared with 22,000 in 1947 (personal communication, Maine Department of Manpower Affairs). The number of jobs per million board feet of sawlogs declined by 61 percent between 1952 and 1977 and the number of jobs per million cords of pulpwood declined by 24 percent during the same period (Irland 1977, Maine Bureau of Forestry 1978; U.S. Bureau of Census 1979). Employment in the paper and allied products industry has remained relatively constant since 1947 at around 18,000. Although there are now more pulp mills then 30 years ago, mill mechanization has kept employment levels constant (personal communication, Maine Department of Manpower Affairs).

Twelve pulp mills and about 150 sawmills process spruce and fir in Maine. In 1978, pulpwood mills were operating at 90 to 95 percent capacity, while sawmills were operating at 57 percent, down 3 percent from 1977 (Maine Bureau of Forestry 1979b).

Maine's spruce-fir resource also has international economic importance. Canadian mills process significant volumes of spruce-fir sawtimber imported from Maine. In 1979, 47 percent of the spruce-fir sawlog volume harvested in Maine was exported to Canada (Maine Bureau of Forestry 1980). This was down from 63 percent in 1975 (Maine Bureau of Forestry 1976). However, some wood is also imported from Canada. The volume of finished product imported to the United States from Quebec exceeds the volume of raw material exported from Maine to Quebec (Falk 1977). Some pulpwood is shipped from Canada to Maine. In 1977, the amount of softwood pulpwood from roundwood including spruce-fir exported from New Brunswick to Maine was about 12 million cubic feet (Nevel and Dickson 1979). Canadian workers are dependent on Maine's spruce-fir resource. In 1974, 2,250 Canadian millworkers were employed in Canada to process Maine timber representing a payroll of $17.2 million (Falk 1977). According to the 1970 U.S. Census, Canadian citizens comprised 29 percent of the work force engaged in spruce-fir logging in Maine.

The ownership of forest land and mills is highly concentrated. Most of the spruce-fir forest is in large private holdings. Figure 11 shows land owned or managed by seven major companies. The four largest companies own or manage 40 percent of the land in the Spruce-Fir Protection District. The four largest sawmills, which are owned by paper companies, account for 65 percent of production, and obtain only 15 percent of their wood from other landowners (Falk 1977).

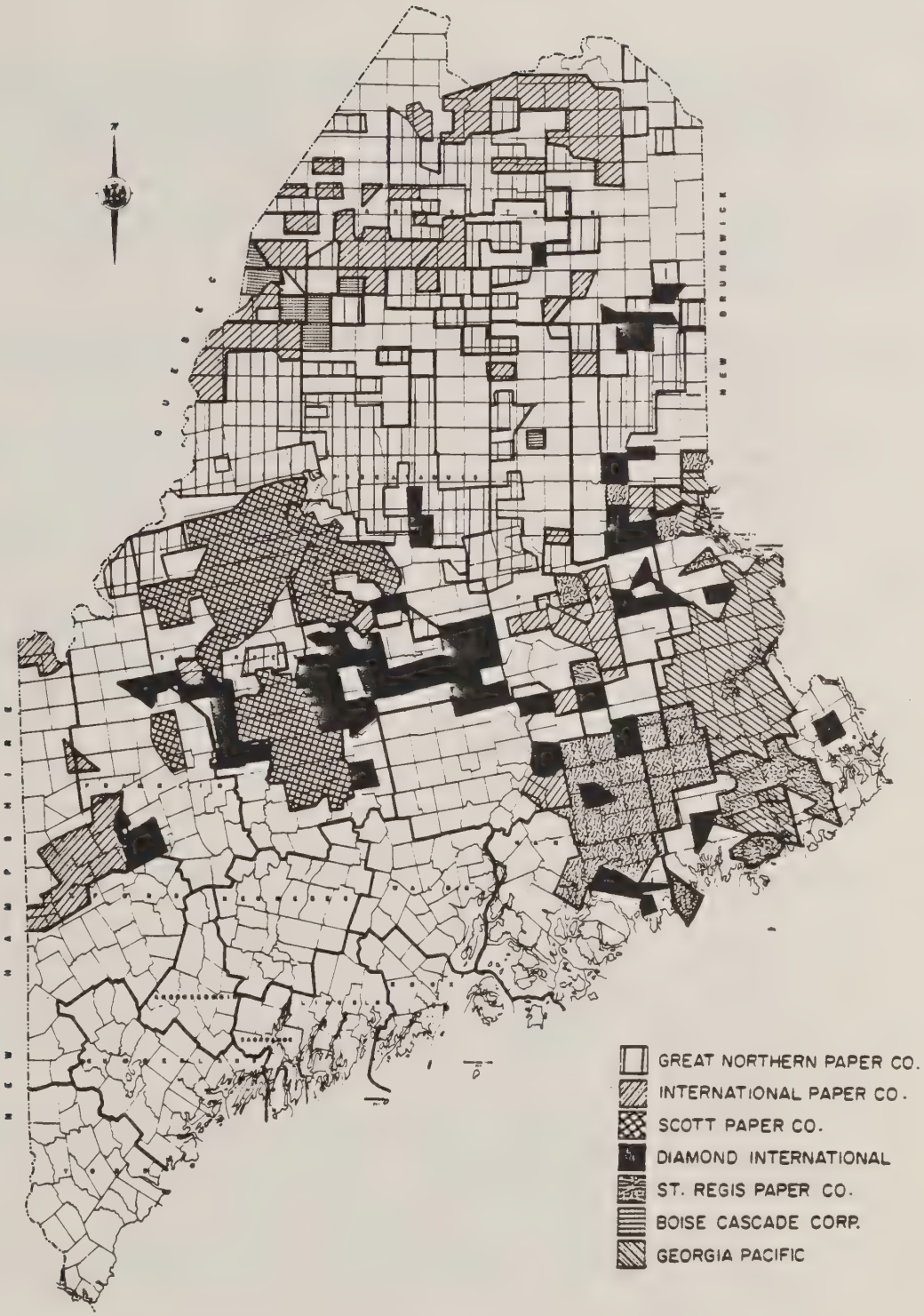


Figure 11 . Major land holdings of seven companies in Maine within Spruce-Fir Protection District, 1970.
Source: Maine Land Use Regulation Commission.

An interdependency exists between industrial and non-industrial landowners. Non-industrial owners depend on industrial owners for a market and industrial landowners depend on non-industrial owners for portions of their wood supply. About 50 percent of spruce-fir pulpwood and 31 percent of the sawlogs processed in Maine mills are purchased from lands not controlled by the manufacturer (Field 1980b). Falk (1977) reported that sawtimber stumpage prices are generally non-competitive.

The interdependency between industrial and non-industrial landowners has been a significant concern in administering the State's insecticide protection program. Some non-industrial landowners have withdrawn large portions of their properties from protection. The cost of insecticide application and the apparent inability of non-industrial landowners to offset these costs through stumpage sales is probably a major reason for their withdrawal. The effect of these withdrawals on spruce-fir supply in the long term has not been determined.

Recent supply and demand projections by Field (1980a) and Green Woods Project (1980) have provided some significant insight into how much spruce-fir should be protected from spruce budworm, or how much spruce-fir could be lost without adversely affecting Maine's spruce-fir industry and employment. The Green Woods projections also provide information on the structure of the future forest. These preliminary projections could be revised over the next 5 years as new supply-demand projections become available.

A report by Field (1980a) gives estimates of the spruce-fir demand potentials for both current and future consumption levels. According to this report a sustained flow of about 2.8 million cords of spruce and fir is needed to maintain existing milling capacity in Maine at the average production-capacity ratios typical of recent years. Preliminary forecasts of demand potential show demand rising from the current level of 2.8 million to almost 3.5 million cords by the year 2000 and almost 4 million cords by the year 2020.

Preliminary spruce-fir supply projections have been prepared by the Green Woods Project (1980). Among the conclusions that can be drawn from these projections are the following:

(1) Regardless of the future level of protection, the annual harvest of spruce-fir will exceed growth for several decades if harvest is maintained at or above 1978 levels (Figure 12).

(2) Spruce-fir growing stock inventory reached a maximum in 1977. Whether protected from spruce budworm or not, and under all future management strategies considered, growing stock levels will continue to decline for several decades due to the older age classes. Without protection inventories will decline more rapidly than with protection (Figure 13).

(3) Because of the current badly imbalanced age class distribution, protection would have to be maintained on the large acreage of old stands for at least 40 years in order to allow time to correct the

deficiency in younger age classes. A regulated forest is seen as relatively easy to achieve if 4 million acres are protected over the next 4 to 6 decades and seen as more difficult to achieve if only 2 million acres are protected over the same period of time.

(4) If the spruce-fir forest were brought under regulation, it would grow at a rate of 296 million cubic feet per year - 32 percent above the current harvest rate of 225 million cubic feet per year.

(5) A protection area smaller than 3 million acres would not sustain supply at current demand levels in the long term.

(6) Achievement of regulation is critically dependent on immediate and complete regeneration.

(7) Accelerated salvage would have an insignificant impact on future wood supply (Figure 14).

(8) Growth of spruce-fir is currently declining rapidly and will be negative through most of the 1980's. This is due in large part to movement of many stands into less productive, older age classes. This decline in growth will continue regardless of the level of protection.

(9) If the spruce-fir forest is not brought under regulation during the next several decades, or if protection is withheld, the forest that results will be at least as susceptible to the spruce budworm as the current one which originated after the last budworm outbreak in the early 1900's.

The above spruce-fir supply projections are tentative and further analysis will be required to validate these findings. Potential for increased yields through intensified management were not directly considered. The projections assume that regeneration will take place immediately following harvest. The validity of this assumption is not known, since a regeneration survey has not been conducted. The assumption that regeneration takes place immediately following harvest may compensate for the lack of consideration of intensified management. However, the extent to which this may occur is not known. The possibility may exist that through intensified management practices, spruce-fir growing stock levels in the future could exceed the maximum reached in 1977.

A spruce-fir supply-demand analysis is currently being planned by the Maine Bureau of Forestry. A portion of this analysis may be funded by the USDA Forest Service.

Additional answers to questions about the current condition of Maine's spruce-fir resource will become available after completion of the survey of Maine's forest resource now being conducted by the USDA Forest Service in cooperation with the Maine Bureau of Forestry. This survey will provide estimates of wood supply, demand projections and data for comparison with the survey of 1970.

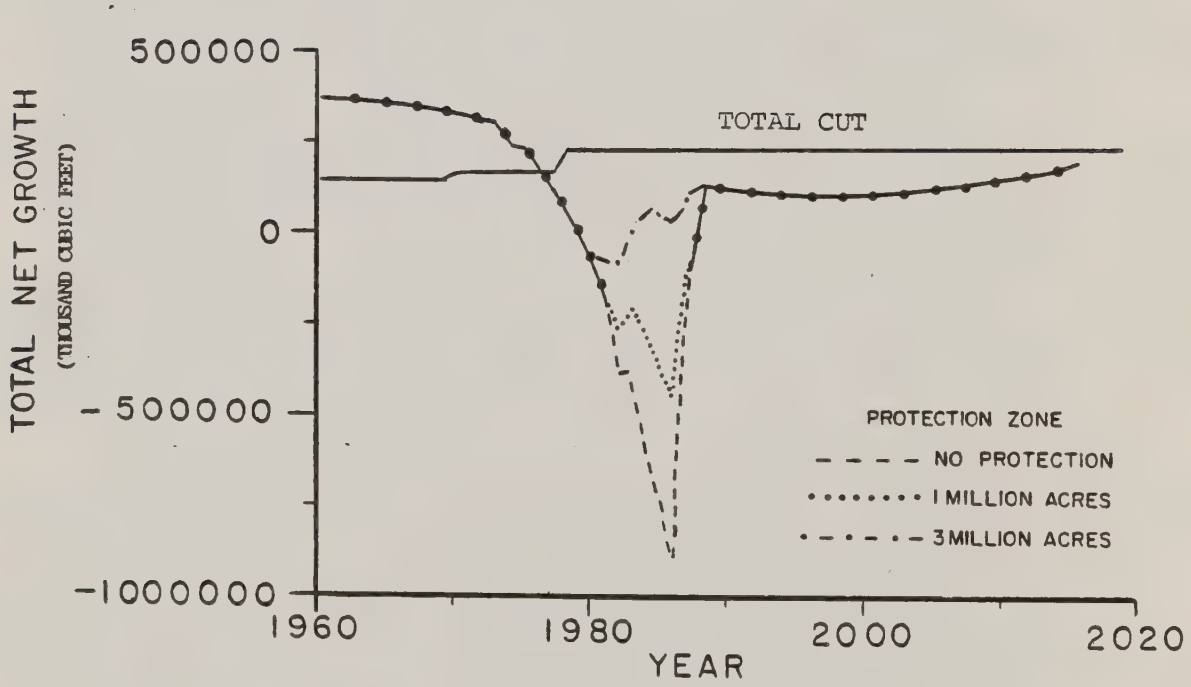


Figure 12. Maine Wood Supply Model predictions of net growth of spruce-fir under three chemical protection zone strategies. Source: Provided by Green Woods Project, School of Forest Resources, University of Maine, Orono, September, 1980.

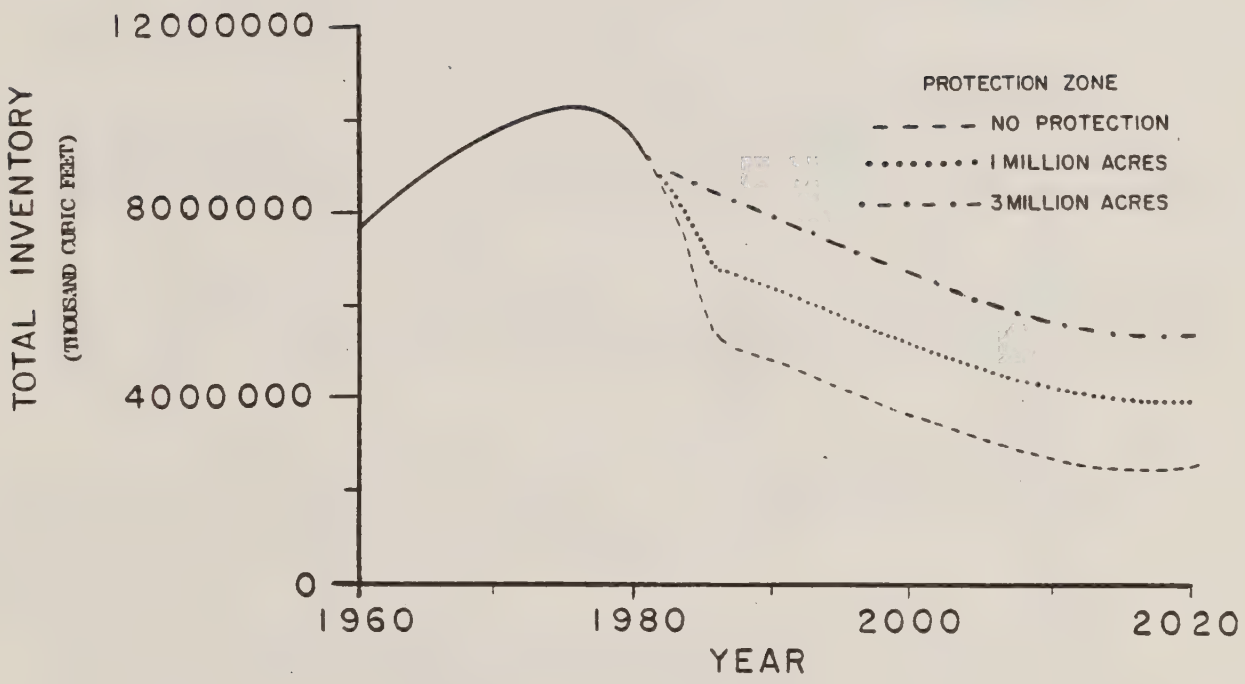


Figure 13. Maine Wood Supply Model predictions of total spruce-fir inventory under three chemical protection zone strategies. Source: Provided by Green Woods Project, School of Forest Resources, University of Maine, Orono, September, 1980.

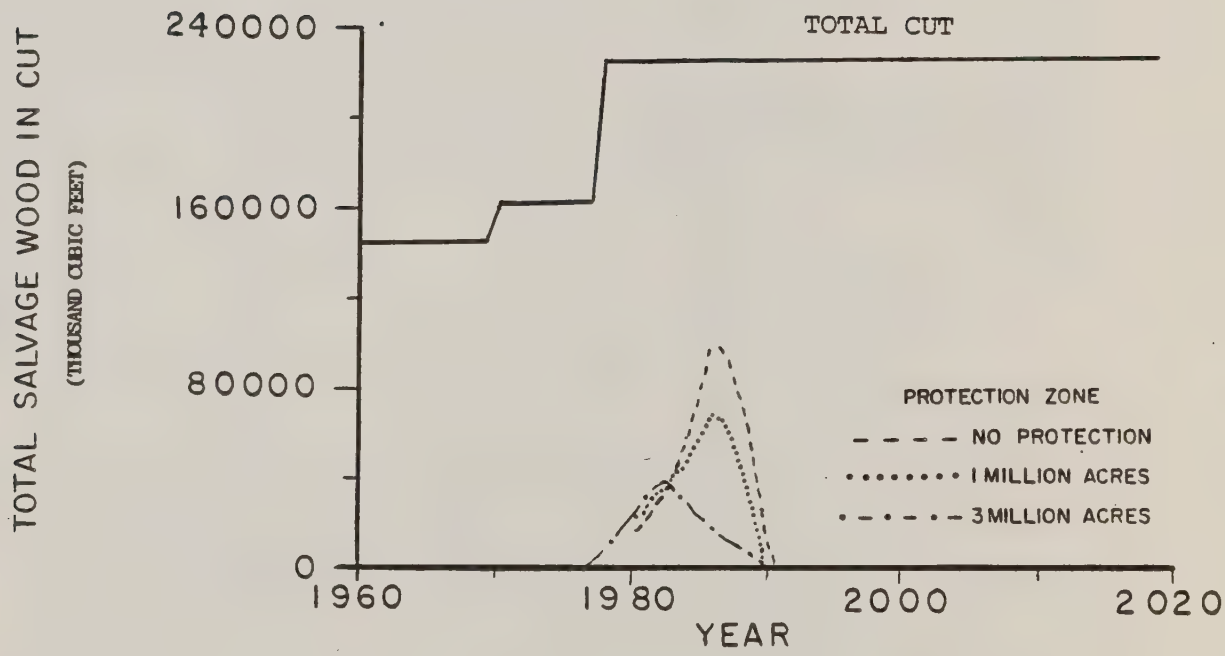


Figure 14. Maine Wood Supply Model predictions of total salvageable spruce-fir cut under three chemical protection zone strategies. Source: Provided by Green Woods Project, School of Forest Resources, University of Maine, Orono, September, 1980.

Information provided regarding present and future protection requirements and flexibility of industry in responding to potential changes in spruce-fir availability is particularly significant in considering future protection programs. A recently completed survey by Field (1980b) of woodland and mill owners provides some previously unavailable information about Maine's spruce-fir economy. Data were submitted by sixteen firms, nine of which have manufacturing facilities in Maine. The sixteen firms manage 90 percent of the State's private commercial forest land in the Spruce-Fir Protection District. Some of the more important findings of this work are summarized below:

(1) The spruce-fir industry provides a total annual cash flow into the State's economy of over $800 million.

(2) About 55 percent of the spruce-fir type is inaccessible at current average skidding distances from existing roads. In 10 years about 24 percent will be inaccessible. Less than 2 percent of the spruce-fir type will remain inaccessible in 30 years. This increased accessibility is expected as a result of normal road development plans.1/

(3) Based on all responses 20 to 30 years will be needed to harvest half the existing mature fir volume at the 1978 rate of fir harvest, and nearly 100 years would be required to harvest 90 percent of this volume.2/

(4) Respondents indicated that they could increase consumption of fir by about 600,000 to 1,000,000 cords over 1979 without serious impact on production costs or sales. Pulp mills could tolerate increased use of fir better than sawmills.

(5) Respondents indicated that they could tolerate a decrease from 1979 spruce-fir consumption levels of only about 5 percent for pulp mills and 10 percent for sawmills without a significant change in production processes. Sawmills could tolerate a decrease of only about 3 percent without encountering customer resistance and only about 6 percent without a loss of customers or a major change in processing costs.

(6) There is more than enough standing spruce-fir timber to meet the demands of the present and near future. Whether sustained yield can be maintained to meet demand in the long term is not clear.

(7) An imbalanced age class distribution exists, with over 60 percent of the spruce-fir stocking (by volume) in the 40 to 69 year-old age class and over 25 percent in the 70+ year-old age class. In other words, over 80 percent of the spruce-fir stocking (by volume) is 40 years old or older.

1/ The Maine Bureau of Forestry indicates that most large landowners are accelerating road building in response to the threat of spruce budworm-caused tree mortality (personal communication).

2/ The Maine Bureau of Forestry indicates that the rate of fir utilization has increased greatly in response to the threat of spruce budworm-caused tree mortality (personal communication).

SOCIAL FACTORS

Many Maine residents have definite views about spruce budworm suppression projects. Some landowners prefer to have their lands protected by insecticides as long as proper safeguards are followed and costs are acceptable. Some landowners prefer to use other methods. Other persons question the potential risk of adverse effects of chemical insecticides to human health and the environment and do not want to be exposed to insecticides in any amount.

In a 1979 poll of Maine residents, 49 percent of the respondents favored protecting the spruce-fir forest using chemicals as one of several means of protecting the forest. Twenty-four percent favored chemical suppression as the chief means of protection, while 21 percent favored no chemical spraying at all (Green Woods Project 1979). The survey was conducted again in 1980 by the Social Science Research Institute at the University of Maine, Orono. Popular support of chemical suppression as the chief means of protection had decreased to 16 percent and support for no spray at all increased slightly to 25 percent. Also the proportion of those polled in favor of using chemicals as one of several means of protecting the forest increased slightly to 53 percent. The results of the 1980 poll are not vastly different from the 1979 poll but may indicate a trend in public attitudes toward the IPM approach to forest protection. However, results also indicate a trend in public attitudes toward a decrease in chemical spraying as the chief means of protecting the forest.

Both the Penobscot and Passamaquoddy Indian Tribes have in the past requested that their lands not be treated with chemical insecticides and have expressed general opposition to the use of chemical insecticides for spruce budworm suppression. Tribal lands in the State include Indian Township, Pleasant Point Reservation, and all islands in the Penobscot River and its tributaries north of Old Town, a total of 27,976 acres. The location of these lands is shown in Figure 15.

Additional lands were claimed by the Maine Indian Tribes and this claim is now settled. The Maine Indian Claims Settlement Act of 1980 enables the Tribes to acquire up to 300,000 acres in Maine before January 1, 1983. While any land within the State may be purchased, only land purchased within the areas indicated in Figure 15 may become "Indian Territory". Indian Territories will be the functional equivalent of municipalities, but will be unique legal entities. Laws governing these Territories have been set up in the Maine Implementing Act (April 3, 1980). The majority of the potential Indian Territory is within the Spruce-Fir Protection District. The effect of these pending land purchases on the proposed IPM program is unclear at this time since the exact location of lands which will be purchased is not known.

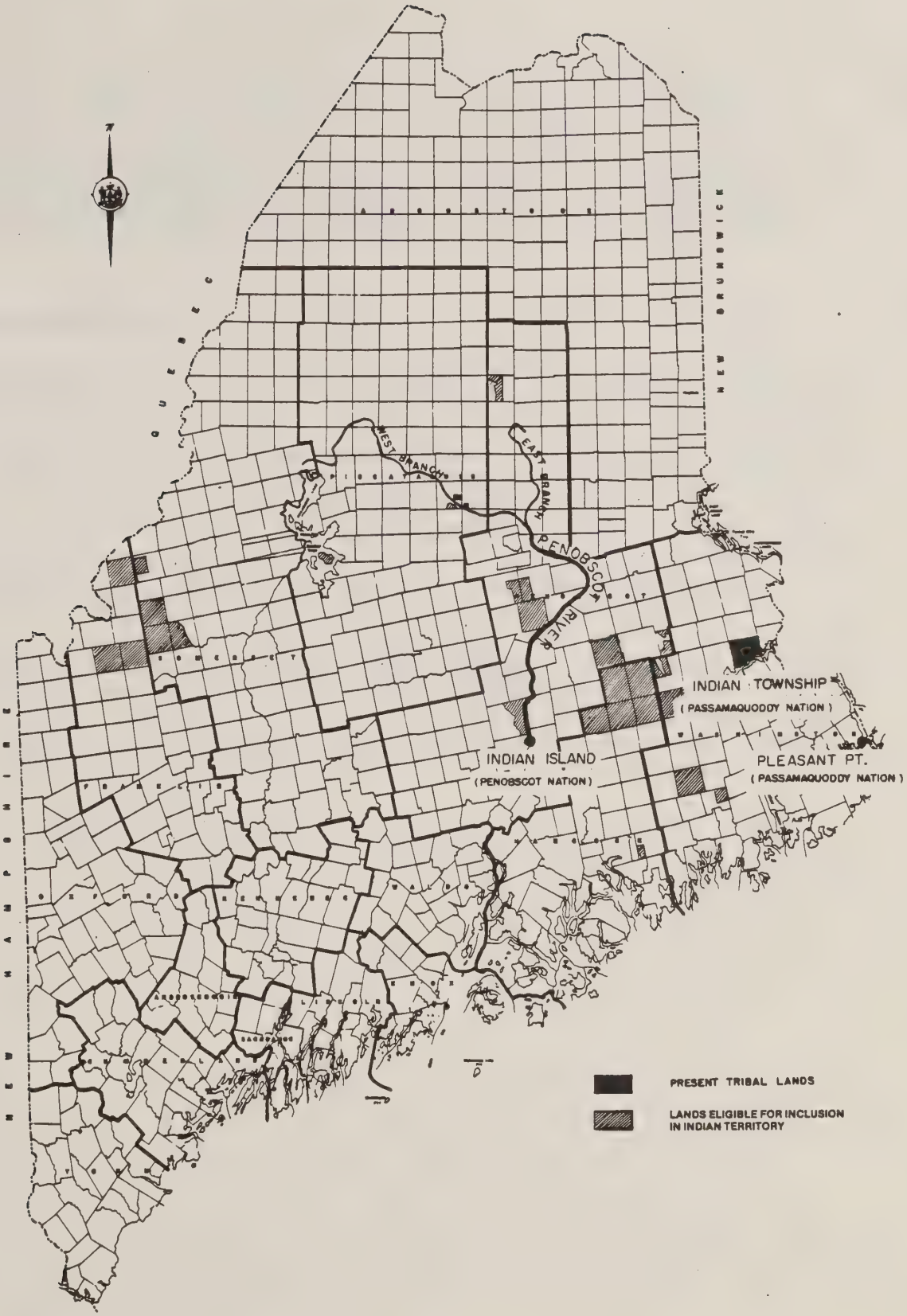


Figure 15. Indian tribal lands and potential Indian Territories within Spruce-Fir Protection District.. Tribal lands include 199 islands in the Penobscot River north of Old Town and in the east and west branches of the Penobscot River further north and other tributaries (i.e. Mattawamkeag and its drainage). Source: Maine Bureau of Forestry and State of Maine Department of Attorney General.

EVALUATION CRITERIA

These criteria were developed from a review of the following: 1) Management goals of the Maine Bureau of Forestry; 2) major issues raised by the public, including landowners during the scoping process were considered to have equal weight and these criteria were used in comparing the benefits of alternative programs (See Table 5, p. 70). and 3) laws and policies governing USDA-Forest Service participation in Federal-State IPM programs.

(1) Minimizes spruce budworm caused balsam fir and spruce mortality.

(2) Provides flexibility to meet changes in resource management objectives and techniques.

(3) Minimizes potential public concern about use of chemical insecticides.

(4) Reduces impacts on non-target organisms.

(5) Reduces chemical insecticide contamination of water and non-target land areas.

(6) Encourages long term development of a forest less susceptible to spruce budworm damage.

(7) Minimizes potential for long term disruption of Maine's forest economy.

(8) Compatible with the objectives of State and Federal laws and policies.

SPRUCE BUDWORM MANAGEMENT METHODS CONSIDERED

During the environmental analysis available methods of spruce budworm management were considered. These methods were viewed singly to identify their components and characteristics before being combined into alternative 5-year programs.

CHEMICAL METHODS

The chemical insecticide products registered by EPA for use against spruce budworm include Sevin® 4 Oil (carbaryl), Dylox® 4 (trichlorfon), and Orthene® Forest Spray (acephate). Several malathion formulations and two fenitrothion formulations are registered. Malathion and one formulation of fenitrothion (Sumithion® 8E) have not been effective in Maine at registered rates. Sumithion® Premix was registered in 1979 on the basis of small plot tests. Its effectiveness on large blocks under operational conditions is not known. The chemical insecticide Sevin® XLR is also registered for spruce budworm control. Any of these insecticides could be considered for use during the proposed program. Also, any new chemical insecticides registered during the 5-year program may be considered for use. Matacil, a chemical insecticide used against spruce budworm in Canada, has been submitted to the US Environmental Protection Agency for registration. Should Matacil be registered, it could be considered for use during the 5-year program. A final decision on insecticides to be used and specific sites to be treated would be made annually.

Other potentially useful chemical methods are pheromones and insect growth regulators (IGR's). A pheromone is currently being tested for spruce budworm population control. It is not likely to be ready for operational use in the next 5 years. Pheromones could be used to disrupt budworm mating thereby reducing population levels in subsequent generations. IGR's could be tried against spruce budworm, but none are likely to be ready for use in the next 5 years.

Insecticides are applied using aircraft. Helicopters and small fixed-wing aircraft would be used as much as possible in spray application. Large fixed wing aircraft may be used for large contiguous spray blocks. Helicopters and small fixed-wing aircraft require airports closer to target areas than large aircraft. However, small aircraft offer advantages of decreased speed, lower spray altitude and greater maneuverability which makes more precise application possible and reduces insecticide drift. Small fixed-wing aircraft and helicopters will generally be used around settlement corridors, on small spray blocks, on blocks where Bt is being applied, on hilly terrain, and in blocks with many sensitive areas.

Sevin 4 Oil is applied in either single or split applications. Split applications are two applications spaced 5 to 10 days apart totalling no more than the registered dosage of 1 pound carbaryl per acre. Maine Bureau of Forestry evaluations indicate that a split application provides slightly better foliage protection than a single application, but is more expensive.

Specific areas or stands to be treated with chemical insecticides would be chosen annually based on biological evaluations conducted by the Maine Bureau of Forestry. Spruce budworm population levels and forest conditions would be evaluated and hazard ratings would be assigned to individual stands or areas (Appendix L). Stands or areas with the highest hazard ratings would receive first priority for insecticide protection.

After specific areas or stands have been selected for treatment with chemical insecticides spray blocks would be set up. Determination of spray block boundaries may be based on criteria similar to the following: hazard, species composition, ownership; management objectives, environmental considerations such as proximity to sensitive areas; and access to airports. Spray block design would strive to: (1) eliminate insecticide application to non-type stands or stands with excessive mortality; (2) minimize spray aircraft turns and overflights of homes, farms, and settlements; (3) provide spray block boundaries that can be easily identified by guides and pilots; and (4) minimize number of sensitive areas within spray blocks to reduce potential environmental impact.

Insecticide applications would be administered by the Maine Bureau of Forestry. During spray application periods the Maine Bureau of Forestry entomology staff would monitor spruce budworm development continuously. This staff would advise project operations staff of the proper timing for applications in each spray block. Individual blocks where budworm population levels and stand conditions no longer warrant protection would not be treated. The Maine Bureau of Forestry would evaluate project effectiveness by: (1) spray deposit assessment; (2) pre-and post-spray budworm population counts; and (3) aerial surveys to assess foliage protection.

The USDA Forest Service would provide technical assistance to the Maine Bureau of Forestry. For example assistance would be provided in calibration of spray aircraft, spray block design procedures, and spray system troubleshooting. The USDA Forest Service would retain an independent responsibility for project monitoring to help ensure that planned environmental safeguards are carried out. Federal funds are provided annually by the USDA Forest Service to the Maine Bureau of Forestry to help maintain an entomology staff and to carry out recurrent insect surveys.

Starting in October 1981, areas to be treated with insecticides would be proposed annually by landowners. Their proposals would be accompanied by a 5 year cutting plan and other forest management information. The Maine Bureau of Forestry would make final selection of areas to be treated based on biological evaluations and a review of landowner cutting and management plans.

Since May 1, 1980, the State of Maine has had a Cooperative Pesticide Enforcement Agreement under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) supported by Grant-in-Aid funds and, hence, has primary responsibility for enforcement of Federal as well as State laws governing pesticide use. The EPA Regional Office responsibility will be to monitor and provide oversight of the State enforcement efforts to help assure that pesticide use in Maine is carried out in a manner consistent with product labeling and other FIFRA provisions.

Several procedures would be followed by the Maine Bureau of Forestry to minimize insecticide contamination of environmentally sensitive areas and help ensure precise insecticide applications. These procedures would include use of buffers (Table 4). The spray contractor would provide aircraft and personnel to guide spray aircraft. Spray blocks near environmentally sensitive areas would be flown prior to spraying to familiarize guides with block boundaries. In addition monitor aircraft and personnel would be assigned by the Maine Bureau of Forestry to the contractors' spray teams and would observe spray operations. Monitors would fly spray blocks before spraying to familiarize themselves with boundaries and environmentally sensitive areas. The Maine Bureau of Forestry would maintain responsibility for contractor compliance with contract and other requirements during the spray operation. Monitors would immediately advise guides and pray team members if deviations from plans occured during spraying. Monitors would have the authority to stop spraying at any time. Monitors would keep an account of each spray operation and record ll mishaps. The spray contractor may be penalized financially for any insecticide not applied according to the contract.

Before and during insecticide treatments, the public would be advised of application plans by such means as:

- news releases
- newspaper advertising
- direct mail to sport and recreation camps, physicians, county medical society presidents, municipal officials, county commissioners and groups including Maine Beekeepers, Organic Farmer and Gardener Association, and Blueberry Growers Association
- telephone calls to citizens who request to be contacted before spraying
- telephone and radio calls to logging crews
- handouts at woods road gates
- public notification posters on woods roads
- commercial radio advisories

An information staff would be maintained at project headquarters. They would respond to inquires about locations identified on spray maps, daily spray plans, and information on possible adverse impacts. Individuals who wish to discuss possible violations of pesticide use precautions would be referred to the Maine Pesticides Control Board.

Table 4. Buffers for Insecticide Application. Source: Maine Bureau of Forestry, 1981.[1/]

	Small Aircraft e.g. Helicopters, Thrush			Large Aircraft e.g. TBM, PV-2, DC-4	
Sensitive areas	Sevin 4 Oil	Orthene Forest Spray	Bt formu-lations	Sevin 4 Oil	Orthene Forest Spray
Permanent human habitation	1/2 mi.	1/2 mi.	1/4 mi.	1 mile	1 mile
Publicly maintained roads	500 ft.	500 ft.	500 ft.	500 ft.	500 ft.
Apiaries	1/2 mi.	1/2 mi.	1/4 mi.	1 mile	1/2 mi.
Organic farms	1/2 mi.	1/2 mi.	1/2 mi.	1 mile	1 mile
Eagle nesting sites	1/2 mi.	1/2 mi.	1/2 mi.	1/2 mi.	1/2 mi.
Blueberry production areas	1/2 mi.	1/2 mi.	None	1 mile	1 mile
Critical Fisheries	500 ft.	250 ft.	None	1000 ft.	500 ft.
Water bodies or streams visible at an altitude of one thousand feet above the terrain	250 ft.	150 ft.	None	500 ft.	250 ft.
Municipal and commercial water supply intakes	1 mile	1 mile	1 mile	1 mile	1 mile

1/ These buffers are subject to change by the Maine Pesticides Control Board.

The public would be advised to stay indoors when insecticides are being applied in their vicinity, if they wish to avoid direct exposure. They would also be advised to wait one full day before entering areas that have been treated if they wish to further minimize their exposure. Women who may be pregnant would be advised that they can avoid exposure by staying indoors during the time insecticides are being applied in their area. This advice is considered to be only precautionary.

In a recent Maine study, individuals who remained indoors during nearby application of carbaryl for spruce budworm suppression were found to have no detectable alpha-naphthol, a metabolite of carbaryl, in their urine with the exception of one person who may have been previously exposed to another source of carbaryl or the insecticide malathion. Persons outdoors at the same locations were found to have detectable levels of alpha-naphthol (South Carolina Epidemiologic Studies Center 1979). The levels detected were far below the occupational standards for exposure to carbaryl. The same study indicated that persons entering spray blocks more than 24 hours after carbaryl application would probably have 5 percent or less chance of receiving detectable exposure to carbaryl (personal communication, Dr. Sandifer, South Carolina Epidemiologic Studies Center).

In 1980 the Maine Bureau of Forestry adopted a new policy concerning the use of Sevin 4 Oil. This policy responded to a health advisory panel's recommendations about potential health effects of Sevin 4 Oil (Appendix B). The Maine Pesticides Control Board is currently reviewing Sevin 4 Oil use and may establish new State-wide application guidelines. Under the current Maine Bureau of Forestry policy, Sevin 4 Oil would be applied only in: (1) areas behind gates controlled by private companies and (2) areas where access roads can be controlled by establishing road blocks or temporary gates. Persons would be advised of potential health risks and asked to express their consent before entering these areas.

The Maine Spruce Budworm Suppression Act, as amended (Appendix H) as well as the new Maine Spruce Budworm Management Act (Appendix I) mandate that areas within 2 miles of publicly maintained roads be designated as settlement corridors and not be treated with insecticides unless landowners specifically request it. In cases where landowners request treatment of settlement corriders a 500 foot buffer would nevertheless be maintained along the publicly maintained road. However, municipalities may prohibit spraying in settlement corridors within their jurisdiction, even though landowners request treatment. Insecticides may be applied around isolated permanent residences without buffers if written permission is obtained. Seasonal dwellings would not be buffered. However, many of these are near bodies of water which would be buffered.

Maine public health personnel would supervise the handling and storage of insecticides. Hospitals and doctors near spray areas would be notified of spray activities, be familiar with the insecticides, and be prepared to handle emergencies. Insecticide handlers and spray pilots would wear protective clothing and equipment, when necessary, to

minimize exposure. Workers with a history of glaucoma, cardiovascular, hepatic or renal diseases, central nervous system abnormalities and use of anticholinergic drugs would be advised about insecticide exposure risks. These workers would be urged to consult with a physician before working on the project.

During 1981, human health monitoring responsibilities would be with the Maine Bureau of Public Health which has been funded by the Maine Bureau of Forestry for this function. At this time specific human health monitoring plans for 1981 and beyond are incomplete. The Maine Bureau of Forestry would carry out studies to monitor the impacts of pesticide application on non-target organisms and biological processes. The following projects along with others are being considered by the Maine Bureau of Forestry for 1981:

(1) An analysis of chemical treatment impact on black duck ducklings weight gain and behavior.
(2) A survey to estimate cumulative impacts of chemical treatment on populations of sensitive aquatic invertebrates over an extensive area.
(3) A study of the indirect impact of chemcial treatment on insect-pollinated plant reproduction.
(4) A study of Bt impact on aquatic invertebrates.
(5) A study of long term impacts of chemical treatment on crayfish populations.

Over the 5-year program the Maine Bureau of Forestry would continue emphasis on studying treatment impacts on non-target organisms and the biological processes in which they are involved.

BIOLOGICAL METHODS

The only biological insecticide currently registered for use against spruce budworm is Bacillus thuringiensis Berliner (Bt). Bt formulations registered by EPA include Thuricide® 16B, Thuricide® 32B, Dipel® 4L and Dipel® SC. Thuricide 24B may soon be registered and could then be used.

Any registered formulation could be used during the proposed program. New Bt formulations may be registered by EPA for use during the 5-year program. A final decision on the formulations to be used and sites to be treated would be made annually. Applications of Bt would be administered by the Maine Bureau of Forestry.

Specific areas or stands to be treated with Bt would be chosen annually based on biological evaluations and environmental consideration. Biological evaluations would consider spruce budworm population levels and stand conditions, and would result in hazard ratings for individual stands or areas. Thus far Bt has provided only limited protection in areas of high budworm populations. Bt use will be primarily in high value stands in environmentally sensitive areas which have relatively low budworm populations. Continued emphasis will be placed on improving operational effectiveness of Bt.

Other potentially useful biological agents are viruses, fungi, parasites, and predators. None of these agents are likely to be ready for operational use against spruce budworm in the next 5 years. However, if any prove useful they would be incorporated into the proposed program.

SILVICULTURAL METHODS

Several silvicultural methods have been identified for dealing with spruce budworm in Maine. These silvicultural methods include:

(1) Shelterwood system. The shelterwood system entails harvest of mature and overmature stands in one or more partial cuts, and removing fir in favor of spruce. Depending on stand and site conditions about one-third of the basal area can be removed. Shelterwood cuts encourage the establishment of spruce seedlings, especially in areas where advanced regeneration is not present, and the development of a high spruce component in the new stand.

(2) Clearcutting. Clearcutting involves removal of all or nearly all merchantable trees in a stand. It is usually applied to mature and overmature stands, or where partial harvest would result in substantial wind damage to the residual stand. The amount of spruce in the new stand is dependent on the amount of spruce regeneration present before the final harvest. Without advanced regeneration of spruce, and protection of this regeneration from damage by heavy harvesting equipment, clearcutting favors the establishment of fir and hardwoods.

(3) Precommercial thinning. Precommercial thinning is the non-commercial felling of trees in an immature stand. Precommercial thinnings reduce vulnerability of the residual stand by removing fir in favor of spruce, increase growth of residual trees and shorten the rotation.

(4) Commercial thinning. Commercial thinning involves a partial harvest of merchantable trees. These thinnings shorten the rotation length, improve the condition of the residual stand and remove trees that might otherwise die. Fir is generally removed in favor of spruce, reducing vulnerability of the residual stand to budworm and encouraging advanced spruce regeneration.

(5) Planting. Planting is the artificial regeneration of a site to, in this case, non-host and less susceptible species. Site preparation is often required. Planting offers the opportunity to regenerate genetically superior trees of the species desired.

(6) Salvage and presalvage cuts. Salvage cuts commercially remove trees that have died. Presalvage cuts anticipate mortality by removing trees which are dying or threatened. These cuts reduce financial loss but have little or no effect on the composition of the succeeding stand.

Application of silviculture methods would be largely the responsibility of private landowners each with their own objectives and constraints. The Maine Bureau of Forestry would provide technical assistance to landowners in applying these methods. For the small non-industrial private landowner, technical assistance is available from the Maine Bureau of Forestry. The USDA Forest Service under the Cooperative Forestry Assistance Act of 1978 provides funds to the Maine Bureau of Forestry for this technical assistance. Financial assistance is available from the Forestry Incentive Program as well as from the Agricultural Conservation Program. These programs share in the costs, up to 75 percent of the non-commercial operations, including planting (conversion), site preparation, and cleaning and thinning. If requested the USDA Forest Service would consider providing technical and financial assistance to the Maine Bureau of Forestry to carry out demonstration or pilot projects of silvicultural methods.

UTILIZATION-MARKETING METHODS

Utilization-marketing methods include: increased use of fir; decreased use of spruce in the short term, increased use of spruce in the long term; increased use of dead trees; increased use of hardwoods; modification of utilization standards to accept a different mix of softwood and hardwood species, smaller sized trees, or dead trees, and development of new markets to use greater quantities of live and dead fir trees that would not otherwise be used.

Application of utilization-marketing methods would be largely the responsibility of private landowners and mill owners, each with their own objectives and constraints. The USDA Forest Service through cooperative programs with the Maine Bureau of Forestry can provide assistance in harvesting, processing, and marketing of forest products to forest industries and private landowners. This assistance includes studies that relate available and prospective wood resources to local or regional demand, production costs, anticipated returns, size and location of markets for end products, and transportation and labor supply. In addition, assistance can be provided to help landowners, loggers, and processors locate markets for their timber and forest products. Assistance can also be provided in developing standards for wood products and their use that increase resource utilization and meet consumer needs. If requested, the USDA Forest Service would consider technical and financial assistance to the Maine Bureau of Forestry to carry out demonstration or pilot projects of utilization-marketing methods.

EFFECTS OF SPRUCE BUDWORM MANAGEMENT METHODS

Chemical, biological, silvicultural and utilization-marketing methods each affect the environment differently. In this section, the effects of each method are discussed. Later the methods are combined, and possible effects of 5-year programs are evaluated.

EFFECTS OF CHEMICAL METHODS

The immediate objective of chemical methods is to keep trees alive until they can be harvested. It is unclear how much protected fir would die from causes other than budworm before it could be harvested. A survey of several woodland owners indicated that 21 to 30 years would be needed to harvest only one-half the mature fir volume in Maine's spruce-fir forest at the 1978 rate of harvest (Field 1980b). This suggests that some of the protected fir might die of old age before it is harvested since fir is relatively short lived when compared to spruce.

The gains expected from use of chemical insecticides are short term. Chemical insecticides would cause a temporary reduction in the spruce budworm populations within the treated areas. Under normal circumstances epidemic budworm populations return to previous levels within 1 to 2 years. The presence of extensive areas of highly susceptible spruce-fir, the large number of untreated areas, and high budworm populations increase the likelihood that high population levels will resurge quickly. Repeated annual treatments are needed to prevent tree mortality. Chemical methods may prolong the current outbreak by keeping the budworm food source alive.

A review of several reports concerning human health aspects of three chemical insecticides used previously in Maine indicates tht these insecticides can be used with a large margin of safety (Appendix A). Precautions that would be taken by the Maine Bureau of Forestry would add an additional margin of safety by greatly reducing human exposure to insecticides. An epidemiologic study conducted in Maine in 1979 indicated that carbaryl exposure in a human population 0.6 mile from the nearest spray block was far below 1 percent of the occupational exposure standard for carbaryl. The results of the same study indicated that even for a person who might inadvertently be in a spray block at the time of treatment, exposure would also be far below the occupational exposure standard, and far below the amount required to cause illness. The study carried out in 1980 by the Maine Department of Human Services showed that although long distance drift of carbaryl did occur, the maximum exposures were approximately 1/1000 of the allowable daily intake of carbaryl recommended by FAO/WHO and was equivalent to the maximum daily dietary intake of carbaryl as determined by USDA market basket surveys. Reports reviewed concerning repeated low level exposure of humans to the insecticides indicated no documented effects.

Populations of some non-target invertebrate species would be reduced temporarily by chemical insecticides. In previous suppression projects using carbaryl, populations of some susceptible aquatic insect species required more than 1 year to return to pre-spray numbers in treated streams. Whether the buffer system will aid in reducing effects and speeding recovery of susceptible populations is not clear but is being investigated. Although little work has been done with mollusks in Maine, studies in other areas indicate that mollusks are relatively resistant to carbaryl levels that would be encountered in operational spray programs. Freshwater crustaceans (crayfish, amphipods, and waterfleas) however may be adversely affected by carbaryl. Amphipod populations were reduced to zero in two ponds experimentally treated with carbaryl in 1980. This study will be continued in 1981 to determine rate of re-colonization. Although marine crustaceans are susceptible, harmful contamination of marine habitats by operational spray is not likely. Any residues reaching marine environments would be extremely small due to dilution and degredation.

The effects of two consecutive annual applications of carbaryl on sensitive non-target organisms are similar to a single exposure. The effects of three or more consecutive or intermittent treatments of carbaryl have not been investigated. However, most areas would not be treated more than two or three times in the coming 5-year period. Some areas that would be treated with insecticides during a 5-year IPM program beginning in 1981 would also have been treated with carbaryl or other insecticides in the past 5 years. A summary of reports concerning effects on non-target organisms (aquatic invertebrates, fish, birds, bees, small mammals, terrestrial insects and spiders, and soil organisms) from three chemical insecticides used previously in Maine can be found in Appendix A. A similar review of fenitrothion can be found in the 1978 Draft Environmental Impact Statement, which is available for public review (Appendix K). If at any time during the 5-year program chemical insecticides other than Sevin 4 Oil, Dylox 4 and Orthene Forest Spray are considered for use, their impacts would also be reviewed in an environmental assessment.

Aquatic insects are a major component of fish diets. However, the temporary reductions of aquatic insect populations susceptible to carbaryl have not affected fish adversely. Research is beginning in Maine to examine potential impacts of reductions in populations of non-target species on ecological processes such as energy and nutrient cycling. A study was initiated in 1980 to quantify the impact of carbaryl caused reductions in populations of leaf shredding insect species in streams, but the study is not complete.

Chemical spraying could affect the insect parasite - predator complex surrounding the spruce budworm. Populations of predators and parasites such as spiders, ground beetles, harvestmen, and tachinid flies may be temporarily reduced by chemical application (Hydorn 1979, Simmons 1975). However, in the studies available no taxa seem to be eliminated by chemical spraying (Hydorn, 1979, Simmons 1975, Andrews 1976). The overall effects of parasite or predator reductions on outbreak levels

of spruce budworm are unclear and further study is needed. Kettela and Varty (1972) noted that parasitism is an important factor, but not a key one, in the dynamics of epidemic budworm populations and they considered it desirable to sustain the parasite complex at a high density so it may influence the budworm populations when they collapse. In the past parasites have not been effective in controlling budworm outbreaks, but they were capable of exerting effective control of populations at endemic or near endemic levels (Morris et al. 1958). It may be important to preserve as many taxa of parasites and predators as possible. The chemical methods considered could provide enough untreated area that the parasite and predator complex would remain intact.

Chemicals under consideration could cause a resistance to develop in Maine spruce budworm populations. Resistance to chemical insecticides can develop in any insect population treated repeatedly with chemical insecticides. No work is presently underway to determine if resistance is developing in Maine spruce budworm populations. However, the chance that resistance would develop in Maine spruce budworm populations seem low. The situation in Maine could be described as one in which resistance would not be likely to develop or would develop very slowly (personal communication, Dr. William Collins, Ohio State University). Reasons for the low chance of resistance development are: (1) the population is not restricted so that survivors of a chemical treatment have no advantage in survival or reproduction; (2) the spruce budworm has only one generation per year so that not more than one selection for resistance occurs each year; (3) not all individuals in the population receive a lethal dosage of the chemical thus diluting the genetic selection process, (4) the chemical pesticides used are relatively short lived (less than 2 weeks) in their effectiveness so that any one generation does not receive continuous exposure to mortality-causing dosages over an extended time period; and (5) only about 30 percent of the population has been treated more than twice in the last 4 years. This becomes more important if resistance is accompanied by a reproductive disadvantage (Georghiou and Taylor 1977). Spray block selection procedures could decrease the rate of resistance development because these procedures attempt to curtail unnecessary pesticide use through more careful block selection. This is one of the methodologies described by Comins (1979) for slowing the development of resistance.

Expected economic effects of insecticide treatments carried out in a 5-year IPM program would be short term. These effects could include: (1) costs to the Federal Government, State, and landowners; and (2) avoidance of tree mortality and monetary loss that would occur in 1981 and subsequent years if chemicals are not applied during the 5 years. If the outbreak continues beyond 5 years, and insecticide treatments are not continued, little benefit would be gained from a 5-year program (Appendix E). However, not to apply insecticides could preclude application of other IPM methods, particularly silviculture, because trees in many areas would die and thus would no longer be available for management or harvest.

Several kinds of economic effects might result from a longer program using chemical insecticides. These include: (1) a more stable contribution of the spruce-fir industry to the economy of the State and region through taxes, wages, and raw materials, (2) possible over

dependence on chemical methods and a consequent reluctance by some landowners to invest in silvicultural and utilization-marketing methods which would lead to long term reduction in vulnerability to budworm; (3) more stable markets for non-industrial landowners, (4) possible continued cost of chemical treatment to the Federal Government, State and landowners; (5) a more stable supply of wood for Canadian mills; and (6) a reduction of the impact of a supply shortfall expected because of the imbalanced age class distribution of Maine's spruce-fir forest. Even with chemical treatment, projections indicate a long term decline in spruce-fir growing stock inventory and timber supply in Maine (Green Woods Project 1980). This expected decline will be due largely to the badly imbalanced age class distribution. Without insecticide protection inventories are expected to decline more rapidly than with insecticide protection.

USDA Forest Service financial assistance for chemical insecticide treatment as part of an IPM program would not exceed 36 percent of the costs incurred annually for: project planning and administration; public information; insecticide purchase, storing, mixing, loading and application; spray aircraft contracting; treatment efficacy evaluation; and environmental effects monitoring. The remainder of the cost would be borne either by the State, landowners or both. The cost of Sevin 4 Oil treatment in 1980 was $4.65 per acre.

Physical effects of chemical treatment could include potential contamination of one or two certified organic farms in the Spruce-Fir Protection District, increased aircraft noise for 3 to 4 weeks around some airports, potential air traffic conflicts, energy consumption, insecticide residue deposit and breakdown, and some loss of insecticide through drift or other reasons (Appendix D). Long range drift of minute quantities of carbaryl was found during both the 1979 and 1980 spruce budworm suppression projects in Maine (Appendices A and D).

The concern and dissatisfaction of some individuals and groups with chemical treatments would continue over the 5-year period. Some temporary displacement of people is likely during insecticide treatment. Some loggers, visitors to the spruce-fir forest and residents may temporarily move to areas away from spray blocks to reduce their chance of exposure to insecticides.

EFFECTS OF BIOLOGICAL METHODS

The only biological insecticide ready for operational use is *Bacillus thuringiensis* Berliner (Bt). Bt has usually been effective only in areas of relatively low budworm populations. Consequently, the usefulness of Bt may be limited because of the relatively high budworm populations that exist over much of the spruce-fir resource.

Bt affects some non-target species of moths and butterflies, and could temporarily reduce populations of these species. A summary of reports concerning effects of Bt on non-target organisms is found in Appendix A.

The USDA Forest Service and Maine Bureau of Forestry cooperated in a 200,000 acre demonstration of Bt in 1980. Preliminary results indicate that Bt will provide enough foliage protection to keep most trees alive (Appendix J).

The cost of Bt treatment in 1980 was $12.50 per acre. This cost was higher than for chemical insecticides ($4.65 per acre) but may be offset somewhat by the lesser environmental impacts of Bt, and the usefulness of Bt in areas where chemicals are not applied because of environmental concerns.

USDA Forest Service financial assistance for biological insecticide application as part of an IPM program would not exceed 36 percent of the costs incurred annually for project planning and administration; public information, insecticide purchase, storing, mixing, loading, and application; spray aircraft contracting; treatment efficacy evaluation; and environmental effects monitoring. The remainder of the cost would be borne by landowners and the State.

EFFECTS OF SILVICULTURAL METHODS

Several silvicultural methods could be applied in Maine's spruce-fir forest. Those methods which could eventually reduce the need for chemical and biological methods during the current outbreak, or reduce the severity of future outbreaks, are considered for possible use in a 5-year IPM program and beyond.

Use of silvicultural methods as a part of an IPM program would be based primarily on the assumption that stands with a smaller component of balsam fir will suffer less tree mortality than stands with a larger fir component. Swaine (1919) observed that stands with a larger component of balsam fir incurred greater losses, and suggested methods to change species composition of future stands. Others have since made similar observations and suggestions (Frank and Bjorkbom 1973; Frank 1977; Frank and Blum 1978). The removal of fir may not necessarily reduce the likelihood of spruce budworm outbreaks (personal communication, Yvan Hardy), but may reduce losses associated with the insect.

The removal of fir in "fir only" cuts has been suggested as a method of reducing stand vulnerability to spruce budworm. However, this does not mean only fir will be removed and spruce will be left untouched in harvest operations. The distribution of fir and volume of fir in most stands requires that some fir be left to reduce wind damage potential. It is also rare that some spruce would not need to be removed due to volume distribution, stand structure and density. The term "fir only" cut refers to selecting against fir during a cut and the degree of this selection is determined by an analysis of stand-site attributes such as species composition, stand structure, residual stand density, and soil type.

Silvicultural methods would not greatly alter the course of the current spruce budworm outbreak, and any effect on present spruce budworm populations would be in local areas where budworm host trees had been removed. However, without increased silvicultural investments during the current outbreak a highly susceptible spruce-fir forest can be expected to regenerate. The extent to which investments in silvicultural methods will be increased is dependent on several factors including mill and market capacities, and the cost of treatment.

In the short term silvicultural methods, by removing trees most vulnerable to budworm damage, could reduce loss from the current outbreak in those areas cutover. Also the need for insecticide protection would be reduced where these methods were applied. It is possible that some stands in which precommercial thinning is done may continue to need protection in the short term since removal of all fir may not be possible. Also spruce may require protection in some cases.

Harvest of mature spruce-fir could have an immediate local effect on reducing the total area susceptible to budworm loss, particularly where the fir component is greatly reduced. Harvest methods also offer the opportunity to change the mix of spruce and fir in the next rotation. Harvesting operations are limited by mill and market capacities and requirements.

Silvicultural methods could lead to better composed and more vigorous stands in the future. These stands would be more easily manipulated and their response to silvicultural methods more rewarding than at present. The need for insecticide protection would be reduced where these methods were applied. Although the exact extent to which the need for protection would be reduced is unknown, it should be related to the amount of fir in the residual stand. Stands in which precommercial thinnings are performed may need protection later in the rotation to protect a large initial investment. However, there are also indications that if silvicultural treatments were incorporated on a large scale, the resultant growth rate might offset any losses that do occur and thereby reduce the need for protection.

Landowners' objectives are to manage about one-half of the spruce-fir type under an even-aged system, and the other half under an uneven-aged system (Field 1980b). Under the even-aged system, final harvest cuts have usually been clearcuts although shelterwood cuts are also used. The shelterwood harvest method can increase the proportion of spruce relative to fir (Frank 1977).

With the shelterwood method, the large diameter spruce trees, "the high seed producers", are left as shelter trees until the site is reseeded. When advanced regeneration of spruce becomes established and reaches a sufficient height, the overstory trees are removed. The shelterwood method is slightly more expensive than clearcutting because of the higher logging costs associated with lower volume removals for each of the two cuts. Clearcuts, on the other hand, might be cheaper to log but if advanced regeneration of spruce is not present, the method is more favororable to fir regeneration.

Also, if artificial regeneration is required to restock a clearcut area then clearcutting could be over six times as expensive as shelterwood cutting (Millar 1980).

Spruce-fir stands should first be thinned when they are about 10 feet in height. Thereafter, periodic thinnings should be at 10 to 20 year intervals depending on the rate of crown closure. The first thinning or cleaning is a precommercial operation requiring an investment from $75 to $125 per acre (Forest Industries Council 1979). This represents a long-range investment of up to 40 to 50 years for final payoff. Even though the returns are high with a potential of increasing yields by two-fold, landowners, particularly non-industrial private owners, are reluctant to make this type of investment. Thinnings, both commercial and precommercial, that remove fir may reduce the total acreage requiring protection.

Frank (1977) found that with intensive management of uneven-aged stands net annual growth improves dramatically (five times that of unmanaged stands), fir to spruce ratios decline, and mortality lessens.

Field (1980b) reported that Maine forest managers have cut fir heavily in their harvesting operations for many years, and despite this, the proportion of fir to spruce volume remained nearly constant from 1959 to 1971. This situation was attributed to the greater number of fir trees and more rapid growth rate of fir. Recent survey data from Maine mill and woodland owners reported by Field (1980b) indicate that almost all owners surveyed are cutting fir heavily. The same survey indicated that 21 to 30 years would be needed to harvest half the mature fir volume at the rate of harvest in 1978, and nearly 100 years would be required to harvest 90 percent of this volume. These findings indicate that significant reduction of fir by harvesting and the application of silvicultural methods is a difficult, long-range procedure. This procedure may be made more difficult if the larger diameter classes of spruce are harvested thus removing the largest seed producers. There are indications that this may be the practice in some areas (personal communication, Bob Frank).

Increased productivity could in the long term lead to a decrease in the total forest area requiring protection. The Maine Forest Productivity Report (Forest Industries Council 1979) concludes that 5.3 million acres of Maine's spruce-fir forest could benefit from cultural treatments to improve productivity. Opportunities to improve seedling-sapling stands (2,515,300 acres) and harvest and artificially regenerate sawtimber stands (2,853,400 acres) have the combined potential to contribute an additional 151 million cubic feet annually. The incremental investment necessary to affect these 5.3 million acres would be $245 million.

Management of fir on a short rotation is another long term approach. This approach could decrease the vulnerability of fir stands to budworm and result in less acreage in need of insecticide protection at any one time. This approach would require utilization of smaller trees for pulpwood or small roundwood.

Planting cutover areas to non-host or less susceptible species is another long term approach to reducing susceptibility to budworm. To date, in Maine, only a small number of plantations have been started, but industrial landowners are increasing regeneration activities. Species being planted include white, red, and black spruce; jack and red pine; and Japanese hybrid and native larch. While some landowners have provided data on acreage planted, complete data is unavailable on the acreage planted in Maine. Costs for establishing plantations range from $50 to $100 per acre for spruce (Forest Industries Council 1979).

Salvage cuts to harvest dead trees and pre-salvage cuts in anticipation of tree mortality can reduce losses. However, salvage has limited usefulness because dead trees become unuseable within 2 to 5 years. Pre-salvage cuts can also reduce losses.

Some adverse effects may result from harvesting operations. Increased runoff of water could be expected from cutover areas, and local stream siltation could occur. Dust and soil displacement could occur while building timber access roads. These effects are avoidable. However, if they do occur, the effects are local and short term, and are not expected to increase above current levels since total harvest would remain about the same because of limited mill capacity.

Silvicultural methods would be of little benefit if carried out for only 5 years, and would need to be carried out on a continuous basis for long term changes to occur. The potential long term effectiveness of silvicultural methods in reducing spruce budworm losses has not been proven on as vast an area as Maine's spruce-fir forest.

Application of silvicultural methods could lead to changes in employment. For example, precommercial thinning and planting could require additional employees. Any increase in employment is dependent on the level of commitment to silvicultural methods and the level of mechanization used.

Application of silvicultural methods is expected to vary widely among landowners. Methods will vary depending on landowners' objectives, particularly the species and size of timber needed to meet market and mill demands. For example, some landowners may favor spruce over balsam fir in their management, whereas others, because of market or mill requirements, may favor balsam fir - the species more likely to be killed by spruce budworm. Landowner emphasis on precommercial investments in thinning and planting non-host species may also vary. Landowners' objectives and practices will affect protection needs.

Several large landowners have indicated committments to apply silvicultural methods and have increased their staffs responsible for spruce budworm management. These landowners have indicated commitments to plant less susceptible species, discriminate against fir in harvesting operations and apply precommercial thinnings to further reduce fir in young stands. Based on data provided to the Maine Bureau of Forestry by landowners, site preparation and planting of species less susceptible to spruce budworm would be increased

over the 5 years, and by 1985 would take place on about 15 percent of the acres clearcut annually. This would represent a total investment by industry over the 5 years of about $3,750,000. Pre-commercial thinnings would be carried out on a total of about 50,000 acres over the 5 years, a total investment of about $5 million.

Costs of applying silviculture practices, cleaning, thinning, site preparation and planting on industrial lands would be borne primarily by the industrial landowners. The non-industrial private landowners can obtain cost-share assistance of up to 75 percent of the cost under the Forestry Incentive Program and the Agricultural Conservation Program. The Maine Bureau of Forestry provides technical assistance under these incentive programs and has the expertise to provide technical assistance to the large industrial landowner as well.

EFFECTS OF UTILIZATION-MARKETING METHODS

Several utilization-marketing methods could be applied in conjunction with silvicultural methods to reduce the need for chemical and biological methods during the current spruce budworm outbreak or reduce the losses that could occur in future outbreaks. These methods are considered here for possible use in an IPM program. The exact effects of these methods are difficult to predict since methods vary widely among different mills. Some mills have more flexibility than others.

Utilization-marketing and silvicultural methods are strongly interdependent. Changes in one group of methods could not be made without changes in the other.

Utilization-marketing methods would not significantly alter the course of the current spruce budworm outbreak. However, accelerated utilization of fir, the tree most likely to be killed by spruce budworm, could help reduce potential losses from the current outbreak and reduce the size of the area requiring insecticide protection. Results of a recent survey (Field 1980b) indicate that use of fir in pulpmills could be increased by about 900,000 cords over that amount used in 1979 without a significant change in production processes, an increase of over 70 percent. However, responses from individual mills varied from 0 to 325 percent. Groundwood process mills could tolerate large amounts of fir. Hardwood mills are mostly located at some distance from the large concentrations of fir in the northern part of the state, so increased use of fir at these mills would entail increased transportation costs. Sawmills reported much less tolerance for increased use of fir than pulpmills. Most sawmills indicated that increased use of fir of 20 to 30 percent could be tolerated without major changes in production costs or significant resistance from customers.

Increased use of dead and dying trees could allow for greater reduction of loss due to mortality, and a planned reduction in use of insecticides for areas that could easily be salvaged. Potential for utilization of spruce budworm-killed timber depends on the type of product desired and increased costs due to harvesting and handling difficulties. In general, wood quantity and quality decrease, and processing and

harvesting costs increase with the number of years since the tree died. Sawlog quality decreases rapidly, within 1 year after death of the tree. However, trees may be used for chips and pulp for 2 to 5 years after death (Lee and Field 1978). Field and Shottafer (1979) discuss work published by Hatton who found in New Brunswick that the following percentages of dead wood may be used with sound wood in kraft and sulfite processes: 50 percent of wood dead 0 to 2 years; 25 percent of wood dead 2 to 4 years and none after 4 years.

Grading rules for spruce-fir timber allow any mixture of spruce and fir. The Northeastern Lumber Manufacturers Association states in their Standard Grading Rules for Northeastern Lumber that "Eastern spruce and balsam fir make a shipping combination determined by market demand and actual standing timber mixtures. Such a shipment will be grade stamped or invoiced Eastern Spruce - Balsam Fir". This grading rule could allow increased use of balsam fir in those mills not currently using large quantities of this species.

Increased use of hardwood could reduce dependence on spruce-fir, thereby reducing impact of spruce budworm caused tree mortality. Factors that limit use of hardwoods are the pulping processes and the final product desired, and location of mills in Maine using hardwood pulpwood. Most of the pulp mills in Maine that can use hardwoods are in the southern half of the State, where hardwoods are ample (Ferguson and Kingsley 1972). However, large quantities of hardwoods are also present in the northern half of the state (Ferguson and Kingsley 1972). Their use would depend on changes in existing mills there or building of new mills.

Leaving spruce uncut while fir and hardwood are used, could extend present inventories and reduce the impact of the current outbreak. However, increased use of fir by pulp mills could mean a decrease in use of hardwoods, not spruce (Field 1980b). Sawmills have reported some tolerance for increasing amounts of fir in mixed spruce-fir shipments. However most sawmills could only use 21 to 29 percent more fir before experiencing increased production costs and significant customer resistance (Field 1980b). The ratio of spruce to fir sawtimber cut has remained almost unchanged for the past several years.

Increased utilization of smaller trees could allow for an increase in thinnings of younger stands to remove fir. More efficient use of trees such as whole tree chipping could increase yields per acre and could reduce acreage that needs to be protected with insecticides.

Expanding or changing markets could help increase use of silvicultural methods to reduce spruce budworm impacts. A plant for manufacturing pellets for fuel is being constructed in Maine, and plans exist for two or three additional plants. The plants will each use about 180,000 cords per year, of which a significant portion may be fir (personal communication, Maine Bureau of Forestry). Manufacturers of chipboard or similar products, or different paper products could allow for increased use of fir and an increase in acreage under intensified management. If new products and markets require the same size trees

as current pulp mills and sawmills, overall protection needs are likely to increase. If, on the other hand, smaller trees or dead trees could be used, less acreage might need to be protected.

Application of utilization-marketing methods could lead to changes in employment. Presumably overall employment would increase but local decreases could result in the long term where mills are highly dependent on fir. The increased harvest of fir could lead to increased adverse effects associated with harvesting operations (discussed under silvicultural methods).

Application of utilization-marketing methods would vary widely among landowners and mills. Methods would vary depending on landowners' and mill owners' objectives, particularly the species and size of timber needed to meet market and mill demands. Some landowners and mill owners may have difficulty justifying development of markets and facilities for handling any additional budworm killed timber since this timber would be available for only a relatively short period of time.

Costs of applying utilization and marketing methods would be borne primarily by landowners and mill owners. The Maine Bureau of Forestry would provide technical assistance to landowners and mill owners in applying these methods and may consider demonstration or pilot utilization-marketing projects. If requested, the USDA Forest Service would consider financial assistance for these projects.

ALTERNATIVE 5-YEAR PROGRAMS CONSIDERED

Alternative programs were formulated in two steps: (1) available methods of spruce budworm management were reviewed; and (2) available methods were combined into alternative 5-year Integrated Pest Management (IPM) programs for further examination and study. A 5-year program period was selected since over this period of time spruce budworm conditions and available technology are not likely to change greatly.

The alternative programs were designed to be responsive to major short and long term issues and concerns and to offer a range of technically feasible options based on the following assumptions: (1) a combination of methods will be more effective than any single method, (2) short term methods must be applied while long term methods are developed, applied and begin to take effect, (3) chemical methods will continue to be the most reliable short term component of IPM, (4) biological methods are less effective but more environmentally acceptable than chemical methods, (5) implementing a mix of control measures will lessen adverse environmental impacts stemming from any single measure because there is less reliance on any single measure; (6) application of silvicultural and utilization-marketing portions of IPM must be increased; (7) IPM is probably the most cost-effective approach to a long term insect control problem such as the spruce budworm; and (8) landowners are committed to increased investments in IPM, particularly silvicultural and utilization-marketing methods.

The alternatives considered were as follows:

(1) IPM involving an increase in silviculture and utilization-marketing, while the use of chemicals and biologicals remains constant.

(2) IPM involving an increase in silviculture and utilization-marketing, while the use of chemicals is reduced and the use of biologicals remains constant.

(3) IPM involving an increase in silviculture and utilization-marketing, while the use of chemicals is reduced and the use of biologicals is increased.

(4) IPM involving an increase in silviculture and utilization-marketing, while the use of chemicals is eliminated and the use of biologicals is greatly increased.

(5) No Action (Makes no provision for any spruce budworm management except salvage and other harvesting).

An IPM program would involve application of a combination of chemical, biological, silvicultural, and utilization-marketing methods. Some methods such as chemical insecticides have been used extensively in the past. Silvicultural methods other than harvesting have not been used extensively.

The alternative 5-year IPM programs would be applied to the approximately 8 million acres of spruce-fir type in Maine. Under the first alternative, the 5 million acres of this type in high or extreme hazard condition would be protected with insecticides. Chemical and biological insecticides would be applied annually to an average of about 1.9 million acres. Under the second alternative, 3 million acres of the spruce-fir type in high or extreme hazard condition would be protected with insecticides. Chemical and biological insecticides would be applied annually to an average of 1.4 million acres. Under the third alternative, 3 million acres of the spruce-fir type in high or extreme hazard condition would also be protected with insecticides. Significantly intensified spray block planning, improved resource surveys, and precise applications would permit protection of this acreage by applying insecticides annually to an average of about 1.1 million acres. Under the fourth alternative, about 1 million of the 5 million acres of the spruce-fir type in high or extreme hazard condition would be protected with Bt. Bt would be applied annually to an average of about 500,000 acres over the 5 years. Precise spruce budworm population data over large areas, greatly intensified planning, and precise applications would be required to plan Bt use under this alternative. Under all four of these alternatives, some of the acres under protection would be treated two or more times with insecticides.

The size of area treated annually with insecticides would be based on the alternative selected and on yearly biological evaluations of budworm populations and tree conditions. The specific areas to be protected would be identified by the Maine Bureau of Forestry in cooperation with landowners. With the fifth alternative no action would be taken except salvage and other harvesting.

A decision to consider protection of 5 million acres under alternative 1 was based on the historical level of insecticide use under currently existing hazard conditions. Over the past 5 years, an average of 1.9 million acres were treated annually with insecticides, with annual treatments ranging from 921,000 acres to 3,500,000 acres.

A decision to consider protection of about 3 million acres under alternatives 2 and 3 was based on limitations caused by recent extensive withdrawals of lands from protection by landowners under provisions of State law, some motivated at least in part by increasing protection costs, and on tentative supply projections indicating a need to protect a minimum of 3 million acres in the long term.

A decision to consider protection of only 1 million acres under alternative 4 was based on several considerations: (1) a need to compare effects of a program using chemicals and biologicals with a program using only biologicals; (2) the relatively high cost of Bt; and (3) possible reluctance by landowners to use Bt on a large scale since they would pay the largest share of application costs.

Spruce-fir stands would be selected for insecticide protection based on several considerations. To the extent possible, both old growth stands and young stands would be protected. The objective of this

strategy would be to retain a range of age classes to help reduce future supply disruptions. However, because of the imbalanced age class distribution with a predominance of mature and overmature stands this strategy would have only limited effectiveness. In addition protection emphasis would be on stands with the highest ratio of fir to spruce, and on stands on the most productive sites. Consideration would be given to protection of stands with a high spruce component if spruce mortality were imminent and budworm populations were high. Stands that would be protected with insecticides over a 5-year program would be specifically identified on a yearly basis.

Under the first three alternatives silvicultural and utilization-marketing methods would be applied both in the areas not under insecticide protection and in portions of the protection area. Initial emphasis would be on harvest in areas not protected. Harvest would include removal of living trees, trees about to die (pre-salvage) and dead trees (salvage). After about 7 to 8 years, volume of dead trees may accumulate to the extent that further increases in salvage would not be economically or physically possible. In addition, silvicultural methods such as precommercial thinning could be applied on the protected areas.

The Maine Bureau of Forestry in cooperation with large landowners would seek to increase application of silvicultural methods during a 5-year program. The Maine Bureau of Forestry Budworm Woodlot Management Program is being carried out in cooperation with the USDA Forest Service. It will assist small non-industrial landowners in locating and marketing threatened spruce-fir stands.

Silvicultural methods would vary between mature and immature stands and between stands with different proportions of fir. In mature stands with heavy fir stocking the usual harvest method would be clearcutting. Site preparation and planting of species less susceptible to spruce budworm would be increased over the 5 years, and by 1985 would take place on about 15 percent of the acres clearcut annually. This will represent a total investment by industry over the 5 years of about $3.75 million by 1985. Almost all other harvest cuts in mature stands would involve harvest of primarily fir. In mature stands with low fir stocking, the fir component would be permitted to die, and management of the stands would be concentrated on remaining species less susceptible to spruce budworm. In immature spruce-fir stands, precommercial thinnings would be carried out to reduce fir stocking and improve growth of residual spruce on a total of about 50,000 acres over the 5 years, a total investment of about $5 million. Precommercial thinnings would be used increasingly to control species composition on naturally regenerated clearcut areas. The extent to which utilization-marketing methods would be carried out has not been quantified. Under the fourth alternative, silvicultural emphasis would be on salvage and pre-salvage, and on thinning as much of the forest as possible to reduce budworm damage. After October 1981, under the new Maine Spruce Budworm Management Act the Maine Bureau of Forestry will request from each landowner as a requirement for spray program participation a 5-year cutting plan and other management information necessary for spray project and management program planning. Under the last alternative (no action) emphasis would be on salvage and pre-salvage.

INTEGRATED PEST MANAGEMENT INVOLVING AN INCREASE IN THE USE OF SILVICULTURE AND UTILIZATION-MARKETING, WHILE THE USE OF CHEMICALS AND BIOLOGICALS REMAINS CONSTANT (ALTERNATIVE 1).

This alternative would allow application of all spruce budworm management methods. Over the 5-year program chemical insecticides would be applied to an anticipated average of about 1.8 million acres and Bt to an anticipated average of about 100,000 acres per year. These levels of insecticide use could vary from year to year contingent upon biological need. The level of chemical use would be about the same as in the period 1976 to 1980; the level of biological use would be about the same as in the period 1978 to 1980. Chemical and biological insecticides would be used to protect an area of 5 million acres. Some acres in this area would be treated two or more times during the 5 years. No spruce-fir areas within the 5 million acres would be removed from protection over the 5 years. Chemical insecticides would be applied to a combination of mature and immature spruce-fir stands. Bt would be used primarily near sensitive areas such as places of human habitation where budworm populations are moderate.

Harvest operations would be concentrated on the susceptible forest not under insecticide protection. Although initially, most harvest would be in those areas not protected, some silvicultural methods would be applied to an increased extent in the protected area. Utilization-marketing methods would also be used to an increased extent.

Precautions taken during insecticide application would include public information and notification, and use of buffers near environmentally sensitive areas such as places of permanent human habitation, streams and lakes, certified organic farms, known apiaries, critical fisheries, and eagle nesting sites.

INTEGRATED PEST MANAGEMENT INVOLVING AN INCREASE IN SILVICULTURE AND UTILIZATION-MARKETING, WHILE THE USE OF CHEMICALS IS REDUCED AND THE USE OF BIOLOGICALS REMAINS CONSTANT (ALTERNATIVE 2).

This alternative would allow application of all spruce budworm management methods. Over the 5-year program, chemical insecticides would be applied to an anticipated average of about 1.3 million acres and Bt to an anticipated average of about 100,000 acres per year. The amount of chemical insecticide use would be reduced as compared to the period 1976 to 1980. The level of biological use would be about the same as in the period 1978 to 1980. Chemical and biological insecticides would be used to protect an area of about 3 million acres. These levels of insecticide use could vary from year to year contingent upon biological need. Some acres in this area would be treated two or more times during the 5 years. Over the 5 years some areas of lowest fir content or lowest value would be removed from protection. Chemical insecticides would be applied to a combination of mature and immature spruce-fir stands. Bt would be used primarily near sensitive areas such as areas of human habitation where budworm populations are moderate.

To capture fir volume that would otherwise be lost over the 5 years, harvest operations would be concentrated on the threatened forest not under insecticide protection. Although most harvesting would be in those areas not protected, some silvicultural methods would be applied to an increased extent in the protected area. Utilization-marketing methods would also be used to an increased extent.

Precautions taken during insecticide application would include public information and notification, and use of buffers near environmentally sensitive areas such as places of permanent human habitation, streams and lakes, certified organic farms, known apiaries, critical fisheries, and eagle nesting sites.

INTEGRATED PEST MANAGEMENT INVOLVING AN INCREASE IN SILVICULTURE AND UTILIZATION-MARKETING, WHILE THE USE OF CHEMICALS IS REDUCED AND THE USE OF BIOLOGICALS IS INCREASED (ALTERNATIVE 3).

This alternative would allow application of all spruce budworm management methods. Over the 5-year program chemical insecticides would be applied to an anticipated average of about 950,000 acres and Bt to an anticipated average of about 150,000 acres per year. The amount of chemical insecticide use would be reduced compared to the period 1976 to 1980. The anticipated level of biological use would be increased over the period 1978 to 1980. These levels of insecticide use could vary from year to year contingent upon biological need. The proposed increase in the use of Bt would be dependent upon improved efficacy of operational treatments. The proposed increase would be re-evaluated each year based on efficacy in previous years and potential for further application improvements. Chemical and biological insecticides would be used to protect an area of 3 million acres. Some acres in this area would be treated 2 or more times during the 5 years. Over the 5 years, based on increased biological evaluation and resource surveys, planning of spray blocks would be intensified. This would involve use of high altitude infra-red photography to provide better type delineation, intensified insect population sampling on a stand by stand basis by landowners and the Maine Bureau of Forestry, and acquisition of increased information on relative spruce-fir composition on a stand by stand basis. These measures along with others would help insure that stands of greatest value needed to help fill an anticipated future supply shortfall would be protected. Small agricultural type aircraft and helicopters would be used to a greater extent to provide for increased precision to treat individual stands. Some areas of lowest fir content or lowest value would be removed from protection. Chemical insecticides would be applied to a combination of mature and immature spruce-fir stands. Bt would continue to be used around sensitive areas such as near human habitation, where spruce budworm populations are moderate.

To capture fir volume that would otherwise be lost over the 5 years, harvest operations would be concentrated on the threatened forest not under insecticide protection. Although most harvesting would be in those areas not protected, some silvicultural methods would be applied to an increased extent in the protected area. Utilization-marketing methods would also be used to an increased extent.

Precautions taken during insecticide application would include public information and notification, and use of buffers near environmentally sensitive areas such as places of permanent habitation, streams and lakes, certified organic farms, known apiaries, critical fisheries, and eagle nesting sites.

INTEGRATED PEST MANAGEMENT INVOLVING AN INCREASE IN THE USE OF SILVICULTURE AND UTILIZATION-MARKETING, WHILE THE USE OF CHEMICALS IS ELIMINATED AND USE OF BIOLOGICALS IS GREATLY INCREASED (ALTERNATIVE 4).

This alternative would involve increased application of biological insecticides and no use of chemical insecticides. Over the 5-year program, Bt would be applied to an anticipated average of about 500,000 acres per year. The objective of Bt application would be to protect a total area of 1 million acres. All acres in this area would probably be treated 2 or more times during the 5 years. Bt would be used primarily for protection of high value timber stands that could not be harvested in the next 5 years. Identification of these stands would become extremely critical. Precise spruce budworm population data over large areas, greatly intensified planning, and precise applications would be required to successfully and economically use Bt. In areas of high spruce budworm populations, higher Bt dosages or split applications may be necessary to achieve effective protection. Success of this program would be dependent upon demonstration of more consistent efficacy of Bt.

To capture fir volumes that would otherwise be lost over the 5 years, harvest operations would be concentrated on as much as possible of the threatened forest not under insecticide protection. Silvicultural methods would be applied to an increased extent in the 1 million acres protected with Bt. Utilization-marketing methods would also be used to an increased extent.

Precautions taken during Bt application would include public information and notification, and use of buffers near particularly sensitive areas such as eagle nesting sites. Under the alternative Bt would be applied mostly in high value forest stands in remote areas.

NO ACTION (ALTERNATIVE 5).

This alternative would make no provision for any spruce budworm management, except salvage, other harvesting, and utilization of dead, dying, and threatened spruce-fir.

Since the Maine Bureau of Forestry is mandated by State law to carry out a spruce budworm management program (Appendixes H and I) it is likely that an integrated pest management program would continue whether or not Federal financial assistance is provided. However, the scope of the program would probably be reduced.

EFFECTS OF ALTERNATIVE 5-YEAR PROGRAMS

The effects of four alternative Integrated Pest Management (IPM) programs, each combining three or four IPM methods, and the effects of no action are discussed in this section. Information discussed previously for each management method is repeated only to the extent necessary to understand interactions between the methods in each program and overall program effects.

Since IPM has never been applied to a spruce-fir forest on the scale considered here, the following discussion is necessarily somewhat tentative and incomplete. For example: (1) the effects of budworm and the imbalanced age class distribution on long term spruce-fir supplies are not entirely clear; (2) since silvicultural methods have not been used for an extended period over a large area their effectiveness is unclear; (3) information on landowner and mill owner plans for implementing silvicultural and utilization-marketing methods is incomplete, (4) although there is no evidence of any effect on human health from past insecticide application, concern will continue that subtle or undetected effects may occur; and (5) although to date studies have indicated that long term (more than 1 year) adverse effects of repeated insecticide treatments exist only on populations of certain species of susceptible invertebrates and that these effects are temporary, concern will continue that long term undetected effects may occur in these or other groups of organisms.

EFFECTS OF INTEGRATED PEST MANAGEMENT INVOLVING AN INCREASE IN THE USE OF SILVICULTURE AND UTILIZATION-MARKETING, WHILE THE USE OF CHEMICALS AND BIOLOGICALS REMAINS CONSTANT (ALTERNATIVE 1).

Chemical and biological methods would minimize tree mortality on 5 million acres in this 5-year program. This would allow harvest and salvage to be concentrated on unprotected areas. Protected areas would be preserved to help fill a spruce-fir supply shortfall expected in 20 to 30 years because of budworm and the imbalanced age class distribution of Maine's spruce-fir forest. Protection would also allow for an orderly increase in silvicultural and utilization-marketing methods on the protected acres. Those methods would in turn help reduce the susceptibility of the existing and future forests to budworm damage. More tree mortality may occur in areas treated with Bt than in areas treated with chemicals.

Short and long term effects of insecticides on some non-target insect populations would not differ from that of the past 5 years. Possible adverse effects of silvicultural and utilization-marketing methods would increase slightly since silvicultural treatments would increase. Recreational use on the private forest lands of northern Maine might decrease slightly during insecticide applications, since some persons might not want to be in spray areas during the months of May and June when spray is applied.

Tree mortality as well as salvage and pre-salvage operations in unprotected areas would leave open areas favorable to some flora and fauna and unfavorable to others. Populations of organisms favored by dense forest would be diminished until the spruce-fir forest regenerates. As an example, damage to deer yards in unprotected areas may result in local short term reductions in deer populations. Hunter visits to the spruce-fir forest might be lowered as a result. In any unprotected stands killed by budworm and not salvaged, fire hazard would increase but the risk of ignition in most areas would be low.

Annual investments in insecticide protection would remain about the same for the 5 years. Benefit-cost ratios for the chemical and biological methods in this alternative are favorable at a discount rate of 4 percent and unfavorable at 10 percent (Appendix E). Annual investments in silvicultural and utilization-marketing methods would increase over the 5 years. Employment levels in the spruce-fir industry might increase with increased emphasis on silvicultural and utilization-marketing methods.

EFFECTS OF INTEGRATED PEST MANAGEMENT INVOLVING AN INCREASE IN SILVICULTURE AND UTILIZATION-MARKETING, WHILE THE USE OF CHEMICALS IS REDUCED AND THE USE OF BIOLOGICALS REMAINS CONSTANT (ALTERNATIVE 2).

Chemical and biological methods would prevent most tree mortality on 3 million acres in this 5-year program. Most budworm caused tree mortality would occur in unprotected areas where salvage and other harvesting would be concentrated. Protected areas would be preserved to help fill a spruce-fir supply shortfall expected in 20 to 30 years because of budworm and the imbalanced age class distribution of Maine's spruce-fir forest. Protection would allow for an orderly increase in silvicultural and utilization-marketing methods on the protected acres. These methods will in turn help reduce the susceptibility of the existing and future forests to budworm damage. Balsam fir mortality will be minimized within the area protected. Some fir mortality may occur in areas treated with Bt.

Expected short and long term effects of insecticides on some non-target insect populations would be less than that of the past 5 years. Possible adverse effects of silvicultural and utilization-marketing methods would increase slightly, since silvicultural treatments would increase. Recreational use on the private forest lands of northern Maine might decrease slightly during the period of insecticide application, since some persons might not want to be in spray areas during the months of May and June when spray is applied.

Tree mortality as well as salvage and pre-salvage operations in unprotected areas would leave open areas favorable to some flora and fauna and unfavorable to others. Populations of organisms favored by dense forest would be diminished until the spruce-fir forest regenerates. As an example, damage to deer yards in unprotected areas may result in local short term reductions in deer populations. Hunter visits to the spruce-fir forest might be lowered as a result. In any unprotected stands killed by budworm and not salvaged, fire hazard would increase but the risk of ignition in most areas would be low.

Annual investments in insecticide protection would remain about the same for the 5 years. Benefit-cost ratios for chemical and biological methods in this alternative are favorable (Appendix E). Annual investments in silvicultural and utilization-marketing methods would increase over the 5 years. Employment levels in the spruce-fir industry might increase with increased emphasis on silvicultural and utilization-marketing methods.

EFFECTS OF INTEGRATED PEST MANAGEMENT INVOLVING AN INCREASE IN SILVICULTURE AND UTILIZATION-MARKETING, WHILE THE USE OF CHEMICALS IS REDUCED AND THE USE OF BIOLOGICALS IS INCREASED (ALTERNATIVE 3).

Chemical and biological methods would prevent most tree mortality on 3 million acres in this 5-year program. Most budworm-caused tree mortality would occur in unprotected areas where salvage and other harvesting would be concentrated. Protected areas would be preserved to help fill a spruce-fir supply shortfall expected in 20 to 30 years because of budworm and the imbalanced age class distribution of Maine's spruce-fir forest. Protection would allow for an orderly increase in silvicultural and utilization-marketing methods on the protected acres. These methods will in turn reduce the susceptibility of the existing and future forests to budworm damage. The level of chemical insecticide protection may allow some fir mortality to occur in the area protected with chemicals. Because of the high cost of Bt and because Bt has not been as effective as chemicals some landowners may be reluctant to have their lands treated with Bt. The increased Bt use could, however, partially offset the reduction in use of chemicals.

Expected short and long term effects of insecticides on populations of non-target organisms would be substantially less than during the past 5 years since fewer acres would be treated. Possible adverse effects of silvicultural and utilization-marketing methods would increase slightly, since silvicultural treatments would increase. Recreational use on the private forest lands of northern Maine might decrease slightly during the period of insecticide applications, since some persons might not want to be in spray areas during the months of May and June when spray is applied.

Tree mortality as well as salvage and pre-salvage operations in unprotected areas would leave open areas favorable to some flora and fauna and unfavorable to others. Populations of organisms favored by dense forest would be diminished until the spruce-fir forest regenerates. As an example, damage to deer yards in unprotected areas may result in local short term reductions in deer populations. Hunter visits to the spruce-fir forest might be lowered as a result. In any unprotected stands killed by budworm and not salvaged, fire hazard would increase but the risk of ignition in most areas would be low.

Annual investments in insecticide portions of this program would remain the same for the 5 years. Benefit-cost ratios for chemical and biological methods in this alternative are favorable (Appendix E). Annual investments in silvicultural and utilization-marketing methods would increase over the 5 years. Employment levels in the spruce-fir industry might increase with increased emphasis on silvicultural and utilization-marketing methods.

EFFECTS OF INTEGRATED PEST MANAGEMENT INVOLVING AN INCREASE IN THE USE OF SILVICULTURE AND UTILIZATION-MARKETING, WHILE THE USE OF CHEMICALS IS ELIMINATED AND THE USE OF BIOLOGICALS IS GREATLY INCREASED (ALTERNATIVE 4).

Biological methods would prevent most tree mortality over 1 million acres in this 5-year program. Although Bt might not provide the same level of protection usually expected with chemicals it should keep most trees alive. Tree mortality would increase greatly over the 5 years on the 4 million acres in high or extreme hazard condition not protected with Bt. After 5 years, the condition of trees in many areas might be too serious to allow recovery even if chemical use were resumed. Orderly implementation of silvicultural and utilization-marketing methods on the protected area would be disrupted as harvest was diverted to salvage cutting on the unprotected area. Dead trees could probably not be harvested for more than 2 to 5 years after death.

A disruption in spruce-fir supply would occur in the long term after salvage of dead trees and harvest of surviving inventory. One million acres would not be sufficient to supply mills at current levels over the long term. A significant supply shortfall could be expected in 10 to 20 years. Employment levels in the spruce-fir industry might drop in the long term because of the reduced wood supply. The next forest would probably be similar to the present and when mature also highly susceptible to spruce budworm.

Bt would temporarily reduce populations of some moth and butterfly species. Other non-target insect groups would not be affected. Eventually, mortality of fir and spruce could temporarily affect stream temperatures, and favor fauna and flora attracted to open areas. Extensive tree mortality would benefit organisms favored by early plant succession. Populations of organisms favored by dense forest would be diminished until the spruce-fir forest regenerates. An example would be deer populations which depend on spruce-fir sheltered "deer yards". Damage to deer yards may result in reduced deer populations. Hunter visits to the spruce-fir forest might be reduced if deer populations were lowered. Fire hazard in stands killed by budworm would greatly increase but the risk of ignition in most areas would be low. After the dead trees deteriorated the fire danger would again be reduced.

Annual investments in Bt use would probably not increase over the 5 years unless cost of this material were significantly reduced. The benefit-cost ratios for the insecticide method in this alternative are unfavorable.

EFFECTS OF NO ACTION (ALTERNATIVE 5).

Should no action be taken, extensive areas of dead and dying trees could be expected at the end of 5 years. After 5 years, the condition of trees in many areas would be too serious to allow recovery even if insecticide use were resumed. Within about 10 years as much as one half of the spruce-fir could die based on records from previous outbreaks. Large amounts of dead timber could not be salvaged in time and would be lost (Appendix E). Hardwood species would be used to offset some of the loss of spruce-fir. With salvage of dead trees, harvest of residual trees and use of hardwoods a supply of wood to Maine's mills could continue for several years, but would ultimately decline below the level needed. A significant supply shortfall could be expected in 10 to 20 years. This supply shortfall is expected with or without insecticide protection because of the imbalanced age class distribution of Maine's spruce-fir forest, but is likely to occur sooner without protection. Employment in the spruce-fir industry may increase temporarily because of increased salvage operations. Employment in the spruce-fir industry would likely drop when timber supplies became insufficient. Implementation of silvicultural methods would be severely restricted due to widespread tree mortality. The next forest would probably be similar to the present and when mature also highly susceptible to budworm. Potential effects of no action on availability of wood for harvest were considered in the benefit-cost analysis for insecticide treatments (Appendix E).

Industrial landowners might reduce wood purchasing from non-industrial landowners as they attempted to harvest their own unprotected wood. In the long term, cut of spruce-fir would decrease. Some pulp mills could use species other than spruce-fir that are currently being underutilized, but the extent to which other species could offset spruce-fir losses might be minimal. Sawtimber users would have fewer alternatives than pulp mills and could be seriously affected. One way to temporarily lessen the effects of a reduced spruce-fir supply would be to follow a cut-storage program similar to Nova Scotia. However, the cost of the Nova Scotia program is very high (over $50 per cord), and the short period that wood could be stored would limit the value of this method.

Current spruce-fir inventory would be largely depleted within 10 to 20 years. A period of 40 years or more might be required before spruce-fir inventories recover to sustainable levels. Since most of the wood cut in Maine is spruce and fir, the extent of economic dislocation would depend on industry success in finding alternative sources of fiber. Possible effects on Canadian industry dependent on Maine spruce-fir resource are not entirely clear, although it is known that some mills in Quebec are highly dependent on Maine's spruce-fir resource.

Eventually, mortality of fir and spruce would temporarily affect stream temperature, cause some changes in forest understory flora, and favor fauna and flora attracted to open areas. Extensive tree mortality would benefit organisms favored by early plant succession. Populations of organisms favored by dense forest would be diminished until the

spruce-fir forest regenerates. An example would be deer populations which depend on spruce-fir sheltered "deer yards". Damage to deer yards may result in reduced deer populations. Hunter visits to the spruce-fir forest might be reduced because of lower deer populations. Fire hazard would increase temporarily but the risk of ignition in most areas would be low. After the dead trees deteriorated the fire hazard would again be reduced. Populations of non-target insects would not be significantly affected.

Most likely the State and landowners would carry out a spruce budworm management program whether or not Federal financial assistance is provided. The Maine Bureau of Forestry is mandated by State law to carry out a spruce budworm management program (Appendices H and I). However, no Federal financial assistance could lead to changes in several phases of spruce budworm management. For example use of silvicultural methods to reduce susceptibility of future stands would probably not continue to increase since some landowners would probably not be able to afford the expense of both insecticide treatment and silvicultural treatment. Furthermore, some non-industrial landowners might not be able to afford to protect their lands with insecticides due to their added expenses without Federal funds.

EVALUATION OF ALTERNATIVES

The biological, environmental, and economic effects of the alternative IPM programs and the no action alternative were compared based on the evaluation criteria (Table 5).

The alternative which best satisfied the evaluation criteria was alternative 3, IPM with an increase in silviculture and utilization-marketing while chemicals are reduced and biologicals are increased.

Alternative 3 would involve some risk of tree mortality in areas with low fir volumes such as mixed wood stands due to intensified spray block planning and insecticide application. This risk would be greater than the risk involved in alternative 1, but mortality loss would probably not accumulate to significant volumes. With alternatives 2 and 3 mortality would be high in areas not protected with insecticides. However, these losses could be greatly reduced by salvage and pre-salvage cuts. The risk of tree mortality loss would be high with alternative 5 throughout the threatened spruce-fir forest. With alternative 4, forest conditions in the areas not protected by Bt would probably be irreversible even with renewed insecticide use at the end of 5 years and with alternative 5, this would be the case over an even larger area. With alternatives 4 and 5 much of the tree mortality could not be salvaged and would be lost.

Alternatives 1, 2, 3, and 4 would allow for a short term increase in use of silvicultural and utilization-marketing methods in areas protected with insecticides. Under alternative 1 the forest within the area protected by insecticides would remain near its present condition, and options for future treatment would remain open beyond the 5 years. Under alternative 3, some deterioration could occur in a few stands removed from protection during a 5-year program. This could to some extent reduce future options. With alternatives 4 and 5, application of long-term silvicultural and utilization-marketing methods would be disrupted as greater quantities of trees died and salvage actions increased. With alternatives 4 and 5, future options at the end of the 5-year program would be greatly reduced and much of the standing timber would be lost.

Alternatives 1, 2, 3, and 4 would maintain conditions favorable to continuation of the spruce budworm outbreak beyond the end of the 5-year program within the area protected by insecticides. With alternatives 4 and 5 the outbreak would also continue after the end of 5 years, but should begin to subside later as forest conditions deteriorated and became less favorable to spruce budworm with the death of balsam fir and some spruces. Under all alternatives fir would regenerate naturally in areas which are unprotected and unmanaged, leading to growth of a new budworm susceptible forest in 40 years or more.

Alternative 1 would protect about 5 million acres, alternatives 2 and 3 would protect about 3 million acres, and alternative 4 would protect about 1 million acres. Information reviewed during this analysis

suggests that about 3 million acres should be protected. This conclusion was based on several considerations: (1) intensification of recent State and landowner efforts to locate and delineate more precisely those stands requiring and justifying protection; (2) the effect of insecticide buffer policies first used in 1979 on the number of acres vailable for protection; (3) the effect of landowner withdrawals ince 1979 (under silvicultural provisions of State law) on the number of acres available for protection; (4) information indicating that much of the mature fir volume is likely to die of old age (non-budworm causes) before it can be harvested whether it is protected or not; (5) upcoming land purchases under the Maine Indian Claims Settlement Act which may remove some lands from protection; and (6) the possibility that landowners can direct harvesting to unprotected areas and save most of the threatened trees in these areas.

Another consideration in determining the size of area considered for protection were preliminary results of supply projections indicating that: (1) a protection area of at least 3 million acres is needed to sustain supply at current levels in the long term; but (2) regardless of the level of protection, some shortfall of spruce-fir supply would occur in the long term because of the badly imbalanced age class distribution of Maine's spruce-fir forest and predominace of slow growing, mature and ov -mature spruce-fir stands. Several assumptions used in the supply projections were tentative and require refinement.

That part of Maine's spruce-fir forest that would not be protected includes; (1) areas not seriously threatened by the spruce budworm; (2) insecticide buffers around environmentally sensitive areas such as streams, bodies of water and human habitation; and (3) forest land withdrawn from protection by landowners with State approval, including lands being treated silviculturally. Landowner withdrawals which include both areas imminently threatened by the spruce budworm and areas susceptible but not yet threatened now total about 2.6 million acres out of the approx mately 7.2 million acres of spruce-fir and mixed wood in Maine's Spruce-Fir Protection District.

Alternative programs 2, 3, 4, and 5 would involve a significant reduction in insecticide use compared to the period 1976 to 1980. Alternative 1 would continue use of insecticides at the level of recent years when an average of about 1.9 million acres were treated with insecticides each year. Intensified biological evaluations, improved resource surveys, and refined spray block design procedures used under alternative 3 would allow for protection of stands of greatest value and a substantial reduction in overall insecticide use compared to alternative 2. Use of chemical insecticides would be eliminated under alternative 4 and use of all insecticides would be eliminated under alternative 5.

Expected short and long term adverse effects on populations of non-target organisms and potential for contamination of non-target areas would be least under alternatives 4 and 5. These effects would be less for alternative 3 than for alternatives 1 and 2.

Over the 5-year period, none of the alternatives would lead to an immediate disruption of Maine's forest economy. However, a supply shortfall could be expected in 10 to 20 years under alternatives 4 and 5 and in 20 to 30 years with alternatives 1, 2, and 3, due largely to the imbalanced age classes of Maine's spruce-fir forest. Alternative 1, 2 or 3 would delay or reduce the severity of the shortfall. These three alternatives would provide for the least economic disruption.

Under all alternatives employment levels in the spruce-fir industry might increase in the short term due to increased emphasis on silvicultural and utilization-marketing methods. In the long term employment could decline under all alternatives because of the anticipated spruce-fir supply shortfall. However, this decline might occur sooner and be more severe under alternatives 4 and 5.

The benefit-cost ratios for the chemical and biological insecticide portions of alternatives 2 and 3 are favorable, the benefit-cost ratios for alternative 1 are marginal, the benefit-cost ratios for alternative 4 are unfavorable, and since the fifth alternative is no action, no benefit-cost ratio was calculated. The benefit-cost analysis assumed that insecticide treatment would be continued at the end of 5 years if needed. If the outbreak continues beyond 5 years, and use of insecticides were not continued, little benefit would be realized from the use of insecticides in the programs being considered. The benefit-cost analysis further assumed that all wood being protected would ultimately be harvested. This assumption may be somewhat weak, particularly for alternative 1, considering that, according to Field (1980b), much of the older growth fir may die before it is harvested, even with protection.

Non-industrial landowners could be more seriously affected by alternatives 4 and 5 than industrial landowners. This effect would depend on the extent to which industrial landowners might reduce wood purchasing as they concentrated on harvesting their own unprotected wood. Under alternatives 1, 2, and 3, industrial landowners would probably continue to purchase wood from non-industrial landowners at current levels.

Table 5 - Comparison of alternative 5-year programs

Evaluation criteria	Alternative programs 1/				
	#1	#2	#3	#4	No action
1. Minimizes spruce budworm caused balsam fir and spruce mortality.	+	0	0	-	-
2. Provides for flexibility to meet changes in resource management objectives and techniques.	+	0	0	-	-
3. Minimizes potential public concern about use of chemical insecticides.	-	0	0	+	+
4. Reduces impacts on non-target organisms.	-	-	0	+	+
5. Reduces chemical insecticide contamination of water and non-target land areas.	-	-	0	+	+
6. Encourages long term development of a forest less susceptible to spruce budworm damage.	0	+	+	-	-
7. Minimizes potential for long term disruption of Maine's forest economy.	+	+	+	-	-
8. Compatible with the objectives of State and Federal laws and policies.	0	0	+	-	-
Net rating	0	0	+3	-2	-2

1/ Rating system: + High probability criterion would be satisfied by 5-year program

0 Medium probability criterion would be satisfied by 5-year program

- Low probability criterion would be satisfied by 5-year program

IDENTIFICATION OF USDA FOREST SERVICE SELECTED ALTERNATIVE 5-YEAR PROGRAM

The 5-year program selected by the USDA Forest Service is alternative 3, Integrated Pest Management (IPM) involving an increase in silviculture and utilization-marketing, while the use of chemicals is reduced and the use of biologicals is increased. Alternative 3 best satisfies the evaluation criteria.

The selected alternative acknowledges the need for continued application of chemical and biological methods over the next 5 years while use of silvicultural and utilization-marketing methods can be increased by landowners. This 5-year program should provide additional incentive and time for landowners and mill owners to further apply and assess silvicultural and utilization-marketing methods, and will help landowners maintain their spruce-fir inventories over this period. Use of chemical and biological insecticides will provide for resource protection needs and should prevent extensive tree mortality which otherwise would disrupt increased use of silvicultural and utilization-marketing methods.

The selected alternative will support the progress already made in reducing reliance on insecticides in protecting only those portions of the spruce-fir resource essential to the State's economy. The anticipated further reduction in use of insecticides as compared to the last few years will require intensification of biological and resource surveys to more precisely identify stands requiring treatment, and will also require more precise insecticide application. Significant progress that has been made and further expected intensification of survey and planning activities by the State and landowners will make this possible. Some additional spruce-fir stands would be removed from protection, including stands least likely to be harvested, stands with the least volume of fir, and stands on the least productive sites.

The selected alternative will provide for increased use of Bt to permit protection of additional spruce-fir stands near environmentally sensitive areas. Increased use of Bt will also allow a decrease in use of chemical insecticides near these environmentally sensitive areas. In our judgement, these advantages outweigh the cost associated with the anticipated increase in the use of B t.

Responsibility for implementation of the proposed IPM program would be shared by the Maine Bureau of Forestry, industrial and non-industrial owners. These landowners would have the major responsibility for increased use of silvicultural and utilization-marketing methods. The magnitude of the infestation, intermingled ownerships affected, and potential for international, national, and regional impacts suggest a Federal role in the proposed, 5-year IPM program.

The insecticide portion of the selected alternative has a favorable benefit-cost ratio (Appendix E).

The use of silviculture, utilization-marketing, and chemical and biological insecticides is recognized as an integral and necessary part of IPM. In the President's 1979 Message to Congress IPM is described as "a systems approach to reduce pest damage to tolerable levels through a variety of techniques, including predators and parasites, genetically resistant hosts, natural environmental modifications, and when necessary and appropriate, chemical insecticides".

If implemented, the selected alternative would guide USDA Forest Service consideration of requests for financial and technical assistance that may be received from the Maine Bureau of Forestry during the next 5 years. Annual requests for assistance in silviculture, utilization-marketing and chemicals and biologicals would be considered by the USDA Forest Service on an individual basis. Any decision concerning financial assistance would be made after completion of a site specific environmental assessment carried out in accordance with the National Environmental Policy Act. Each environmental assessment would consider USDA Forest Service biological, environmental and economic criteria, and the Federal role for financial assistance.

At the end of 5 years, the proposed program would be reevaluated. If at any time during the 5 years substantive new information concerning the effects of the program became available, the need to reevaluate the program under the NEPA process would be considered.

CONSULTATION WITH OTHERS

The USDA Forest Service in cooperation with the Maine Bureau of Forestry held a public scoping meeting in Orono, Maine on August 6, 1980 to help identify major concerns, issues and opportunities related to the proposed 5-year cooperative spruce budworm management program for Maine. The meeting was announced in advance through several newspapers in the State. The newspaper announcement also invited the public to submit written comments. Forty-six people representing various agencies, organizations and interests attended the meeting and thirteen made oral presentations. Seven letters were also received. Specific invitations to the scoping meeting were provided to the Penobscot and Passamaquoddy Tribal Councils.

Major issues, concerns and opportunities identified during the scoping meeting were: the potential threat of spruce budworm to the State's economy; need to initiate a long term management program to replace the past short term approach; concern that a long term IPM program might not be significantly different from the past approach; need for continued reliance on insecticides as a major part of any IPM program; concern that long term undetected adverse effects may occur in humans exposed to insecticides; insecticide application problems such as drift and pilot safety; possible adverse effects of spruce budworm impacts on small non-industrial lands; and extent to which the general public may benefit from possible Federal financial assistance for spruce budworm management.

Following filing with EPA, the Draft Programmatic Environmental Impact Statement (DPEIS) was sent for public review and comment to a large number of agencies, organizations and individuals (Appendix N). A public hearing was held on January 9, 1981 at the University of Maine, Orono to receive further public comments on the DPEIS. Public comments were considered in preparation of this Final Programmatic Environmental Impact Statement. These comments are summarized in Appendix M.

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APPENDIX A

A REVIEW OF SOME OF THE DATA CONCERNING EFFECTS OF INSECTICIDES ON HUMAN HEALTH, AQUATIC INVERTEBRATES, FISH, BIRDS, BEES, SMALL MAMMALS, TERRESTRIAL INSECTS AND SPIDERS, SOIL ORGANISMS, AND DATA CONCERNING INSECTICIDE RESIDUES.1/

HUMANS

Persons who might be present in a treatment area during insecticide application include loggers, rangers, wardens, company personnel, fishermen, campers, canoeists, and hikers. These persons could potentially be exposed to a direct application of insecticide. Persons in non-target areas may be exposed to off-target applications or spray drift. Stream water in target areas containing insecticide may flow into non-target areas and thereby reach persons outside the target areas. Persons who eat food gathered from target areas might also be exposed. Insecticide mixing-loading and aircraft crew members have the greatest probability of exposure.

A large safety margin is suggested by results of an epidemiologic study conducted in Maine in 1979 (South Carolina Epidemiologic Studies Center 1979). This study indicated that carbaryl exposure in a human population 0.6 mile from the nearest spray block was far below 1 percent of the occupational exposure standard for carbaryl. The results of the same study indicated that, even for a person who might inadvertently be in a spray block at the time of treatment, exposure would also be far below the occupational exposure standard and far below the amount required to cause illness. Reports reviewed concerning repeated low level exposure of humans to the insecticides indicated no documented effects.

Carbaryl (Sevin 4 Oil®)

Since it was developed in 1956, carbaryl has become one of the most widely used insecticides. About 25 million pounds were used in the U.S. in 1974 (Dolinger and Fitch, undated). Most of it was used in agriculture, but about 3.75 million pounds were used around houses and in gardens. Such widespread use has prompted considerable investigation into effects which are now better understood than for most insecticides.

Harry (1977) compiled an extensive review of human exposure to carbaryl and concluded that in spite of almost universal exposure in the United States over more than a twenty year period it appears that its safety record is almost unparalleled by any other insecticide.

1/ A similar review of data concerning the effects of Sumithion and can be found in the DEIS for Cooperative Spruce Budworm Suppression Projects in Maine, Vermont, and New Hampshire - 1978. This is a public document and is available for public review (see Appendix K).

Carbaryl was under review by the Environmental Protection Agency for more than 4 years for possible RPAR (Rebuttal Presumption Against Registration) action. RPAR is the process by which a material already on the market is subjected to intensive scientific review and public comment. Following a review, the EPA must decide whether to allow continued use of the material, limit the uses allowed, or remove it from the market. The EPA recently announced that carbaryl will not be RPARed. The announcement included the following statement: "The Agency has concluded that the overall weight of evidence of the extensive data which are currently available does not indicate that risk criteria warranting a Rebuttable Presumption Against Registration for carbaryl have been met or exceeded" (Johnson 1980). Carbaryl was being reviewed primarily because of one study where pregnant beagle dogs fed carbaryl had teratogenic effects in the offspring (Smalley et al. 1968). However, this effect has not been reproduced in subsequent studies (Dougherty et al. 1974).

Carbaryl can enter the body through the stomach, the lungs, and the skin. Carbaryl lowers the cholinesterase level in many animals including man. Cholinesterase splits acetylcholine, the chemical responsible for forming the bond necessary to carry an impulse through the nervous system. If the acetylcholine is not split, the impulse is repeated again and again, and a severe lowering of cholinesterase will therefore result in nerve poisoning symptoms. This cholinesterase depression is reversible in most animals, including humans. Some carbaryl may be stored temporarily in body tissues, but it does not accumulate.

"Carbaryl is not a chronic poison. Test animals can tolerate a substantial percentage of an acutely toxic dose in the diet daily for a lifetime. Levels causing no significant effect are as high as 400 ppm dietary to the mouse, equal to 60 mg/kg body weight daily, or 200 ppm to the rat, equal to 10 mg/kg. Taking the lesser of the foregoing, 10 mg/kg would calculate to 600 mg for a 60 kg person. If this person had 2 square feet of skin exposed to an aerial spray deposit from an application of 1.0 lb carbaryl/acre, he would receive about 20 mg. This is 1/30 of the dose the animals received daily for 2 years. This man would receive it once yearly, or 1/365 of the animal exposure, and would receive it dermally, which is at least 10 times less toxic than when ingested. Accumulation of these factors shows a margin of safety for the man in excess of 100,000 times the no-effect level in test animals." (Personal communication, R. C. Back, Union Carbide Agricultural Products Company).

Acute toxicity to people is rarely a problem with carbaryl. Comer and co-workers (1975) reported that plant workers producing carbaryl are exposed dermally to average levels of 73.9 mg/hr and respiratorily to 1.1 mg/hr of work. Urine samples of plant workers had concentrations of 8.9 ppm 1-naphthol, a metabolite of carbaryl, with average excretion rates of 0.5 mg/hr. In the same study these workers investigated the exposure levels of spray applicator workers and found average carbaryl levels of 59 mg/hr dermally and 0.09 mg/hr respiratorily. They concluded that at these dosage levels concerns about acute toxic effects are minimal. Controlled human studies with carbaryl have been conducted at dosages sufficient to cause significant adverse

effects. One investigation showed that daily administration of carbaryl at 0.06 and 0.13 mg/kg/day for six weeks to human volunteers caused only slight signs and symptoms attributable to the insecticide (Wills et al. 1969). For carbaryl, the oral LD_{50} (amount necessary to kill half the animals in a test population) for rats is 500 mg/kg of body weight. Calculations based on this data indicate that it would take 34 grams to kill a 150 pound person. Additionally, there is little likelihood of human oral exposure in a spruce budworm control project.

Theoretically, a person 75 percent clothed exposed to full spray in the open without respiratorial considerations would require 40 times the application rate (0.75 lb carbaryl/acre) to become moderately ill (Personal communication, Frank Lawrence, M.D., Maine Poison Control Center). However in forest openings, actual dermal exposure studies conducted by the South Carolina Epidemiologic Studies Center (1979) on Maine's spruce budworm spray project resulted in finding a total dermal exposure of 10 mg carbaryl for a person (150 lb) that is 80 percent clothed at the time of application. It is known that 10 percent or less of the carbaryl contacting the skin will be absorbed; thus only 1.0 mg carbaryl or less would be the total a person may receive or 196 times less than the amount of carbaryl needed to become moderately ill (personal communication, Ernest Richardson, Maine Bureau of Health).

In the above study the person respiratorily exposed for 2 hours in the spray area would receive only 0.054 percent carbaryl of the Time Weighted Average (TWA) standards (see page A-7) or a safety margin of 1,834 times the occupational exposure (personal communication, Ernest Richardson, Maine Bureau of Health).

The question of carcinogenic potential of carbaryl in humans was addressed by the Technical Panel on Carcinogenesis of the Secretary's Commission of Pesticides and their Relationship to Environmental Health (Mrak 1969). The panel examined available reports on tests of tumorigenicity conducted on about 100 pesticidal chemicals including carbaryl. Carbaryl was judged "not positive" for tumor induction. For all pesticides in the same category as carbaryl the Panel recommended no action be taken to alter current practice.

The carrying agent and emulsions in the Sevin 4 Oil formulation are a trade secret. However, investigations have shown that the formulation contains no significant quantities of polynuclear aromatics, compounds suspected of being carcinogenic. Non-ionic polymers of polyoxyethylene ethers and nonyl phenol substances which may cause Reye's Syndrome are not present.

There is some evidence to suggest that carbaryl may have teratogenic (causes birth defects) potential. The lowest dose that caused teratogenicity in beagle dogs was 6.25 mg/kg/day or 17.8 ppm per day in the diet (Smalley et al. 1968), no effect was observed at 3.25 mg/kg/day or 8.9 ppm. Another study showed effects at 5 mg/kg/day of body weight (Innes et al. 1969), which was probably about 14.2 ppm (Dolinger and Fitch, undated).

The maximum residue allowed on most human foods is 5 to 10 ppm, however, the allowable residue for some foods can be less. The maximum residue allowed on nuts is 1 ppm, on sweet potatoes and potatoes 0.2 ppm, and on wheat and barley grains zero. The tolerance on most forage crops is 100 ppm (US Environmental Protection Agency 1979).

A teratogenic and reproductive study by Dougherty et al. (1971) with Rhesus monkeys administered carbaryl at 2.0 and 20.0 mg/kg/day, produced no evidence of teratogenic effects but did infer these dosages were associated with a higher abortion rate compared to controls. However, these observations were statistically analyzed and considered to be non-significant and non-dose related (Dougherty et al. 1971).

This study was later repeated and expanded (Dougherty et al. 1974) using 3 groups of 16 pregnant Rhesus monkeys administered carbaryl at 0.2, 2.0 and 20.0 mg/kg/day between days 20 and 38 of gestation to cover the period of major organ development. Untreated and vehicle control groups of 16 monkeys each were also maintained from days 18 to 40 of gestation. A normal distribution pattern of still birth was demonstrated within both the treated and control groups. It was concluded that no statistical inference of teratologic or reproductive effects had been induced as a result of carbaryl ingestion (Dougherty et al. 1974).

The question of potential teratogenic effects in humans is addressed in a letter dated May 16, 1979 from Mr. Douglas D. Campt, Director of Registration Division, EPA, to Mr. William M. Cranstoun, N.J. Department of Agriculture which includes the following statement:

> "Since experimental exposure to carbaryl has caused birth defects in dogs, carbaryl may have some potential to do so in humans, and the Environmental Protection Agency is currently attempting to assess that potential. However, since a teratogenic study of carbaryl in rhesus monkeys was negative, it would appear that the teratogenic potential in humans, if any, is not great.
>
> One can never conclude that risks from exposure to any chemical are zero, and it is only reasonable and prudent to suggest that women who may be pregnant should avoid any unnecessary exposure to carbaryl and other chemicals. This is easily accomplished in the use of carbaryl by remaining indoors or under suitable cover at the time the application is made. Once the spray settles, any further potential for exposure is greatly reduced, and should be of no concern." (Appendix C)

The question of viral potentiation of Sevin 4 Oil was recently studied by two University of Maine researchers. Their data suggest that viral potentiation may be associated with exposure to Sevin 4 Oil. The Maine Bureau of Forestry appointed a panel of medical experts to review this study and to make recommendations concerning the potential health effects of Sevin 4 Oil. They concluded that Sevin 4 Oil poses a "potential but inconclusive health risk" and recommended that the Maine Bureau of Forestry develop more stringent limitations so that "no uninformed or unconsented human exposure will occur during a forest spray operation". A follow up study was undertaken to determine which of the Sevin 4 Oil constituents may be viral enhancing. The data indicate that the active ingredient, carbaryl, is responsible for the viral enhancement. The medical advisory panel reviewed these new findings and felt that the original recommendations were still valid along with several additional statements (see Appendix B).

In 1978 and 1979, field studies were conducted by the South Carolina Epidemiologic Studies Center to measure human exposure to carbaryl during spruce budworm suppression projects in Maine. Urine residue levels found in 1978 are shown in Appendix A Table 1. The following quotations regarding 1978 results are taken from the Draft Interim Report, Measurement of Exposure to the Carbamate Carbaryl: Maine Carbaryl Study, 1978. Medical University of South Carolina, March 1979 - used here by permission of EPA.

> "Human exposure to carbaryl applications during Maine's 1978 Spruce Budworm Suppression Project was monitored by the South Carolina Epidemiologic Studies Center. Except where there had been exposure to carbaryl from either mixing operations or home usage, none of the urine samples collected prior to application were found to contain alpha-naphthol, a metabolite of carbaryl. Analyses of urine samples collected 12 to 24 hours after application found that the cohorts of pilots and aircraft loaders had the highest residues. About one-half of the samples from ecologists and rangers who were working and/or living in the application areas showed small but measureable levels of alpha-naphthol. Of the 49 urine samples collected from residents 12 to 24 hours post application, only seven were positive for alpha-naphthol and ranged from 14 to 38 ppb. From the administration of health effect questionnaires, it was determined that no participant reported symptomatology thought to be related to carbaryl exposure."
>
> "Data presented in the draft 1978 Maine Carbaryl Study report suggest that there were no apparent risks to those workers occupationally exposed to and individuals residing near areas aerially treated with carbaryl. Alpha-naphthol residues in the residential participants indicated that drift did not occur."

Appendix A Table 1 - 1-Naphthol residues in urine samples from persons exposed to Sevin 4 Oil in 1978.[1/] [2/]

Exposure group	Number of tested participants	Total urine specimens tested	Number tested positive	Range of positive tests (ppb)	Median residue level of positive tests (ppb)	Average residue level of positive tests (ppb)
Pilots	5	10	10	41.00-1750.00	121.50	323.89
Loaders	5	9	8	83.00-5540.00	656.00	1144.21
Ecologists	9	17	8	14.00-146.00	28.66	51.87
Wardens/ Rangers/Wives	11	11	5	11.11-25.00	12.14	16.85
Scouts	10	10	4	10.77-23.00	14.58	15.73
Lab Tech.	11	11	3	11.25-16.25	13.68	13.73
Residents	42	50	7	10.00-37.60	14.00	15.63
EPA/Safety	5	6	5	23.00-1250.00	89.14	313.99

1/ Urine 1-naphthol residue analysis; lowest level detectable by this method is 10 parts per billion (ppb).

2/ From Draft 1978 Interim Report, Measurement of Exposure to the Carbamate Carbaryl: Maine Carbaryl Study, 1978. South Carolina Epidemiologic Studies Center, Medical University of South Carolina, March 1979. (Used by permission of EPA)

Because of continued public concern and the need to further investigate the amount of human exposure that results from an aerial application of carbaryl in Maine, another study was conducted in 1979. The objective of this study was to monitor the exposure to carbaryl by measuring its urinary metabolite, 1-naphthol, in persons potentially exposed during the aerial application to forests and to relate this exposure to air sampling. Results of 1979 urine residue analyses are shown in Appendix A Table 2. The following quote regarding results of this work is from the Draft Interim Report, Measurement of Exposure to the Carbamate Carbaryl: Maine Carbaryl Study, 1979. South Carolina Epidemiologic Studies Center, Medical University of South Carolina, November 1979 - used here
by permission of EPA.

> "The National Institute of Occupational Safety and Health (NIOSH) has established a time weighted average (TWA) for occupational exposure to carbaryl. The TWA is a maximum exposure limit for occupationally exposed employees based on a 10-hour work shift, 40 hour work week over a working lifetime. The TWA for carbaryl is 5 mg/m^3. The TWA, when compared to the air sampling results of the Washburn area, indicates that the residents located .6 miles north of spray block 6-14 were exposed to carbaryl concentrations in the magnitude of thousandths of one percent of the permissable occupational level. The highest reported level of carbaryl equivalent is found at Site 1 during the first 12 hours of sampling after application. This level (341.0 ng/m^3) when converted to milligrams equals 0.0003 mg/m^3 or 0.006 percent of the TWA standard. Thus the exposure of residents to carbaryl concentrations in environmental air throughout the sampling period was the smallest fraction of allowable levels mandated for more intensive occupational exposure."

In the 1979 study, individuals who remained indoors during nearby application of carbaryl were found to have no detectable 1-naphthol, in their urine. The only exception was one person who may have been previously exposed to another source of carbaryl or to the insecticide malathion. Persons outdoors at the same location were found to have detectable levels.

Appendix A Table 2 - 1-Naphthol residue in urine samples from persons exposed to Sevin 4 Oil in 1979. 1/ 2/

Exposure group	Number of tested participants	Total urine specimens tested	Number tested positive	Range of positive tests (ppb)	Median residue level of positive tests (ppb)	Average residue level of positive tests (ppb)
Pilots	2	2	1	156.87		156.87
Ecologists	3	3	1	25.75		25.75
Scouts	6	6	4	10.42-17.90	12.80	13.48
Ranger/Family	6	6	2	29.11-62.46	45.78	45.78
Field Tech.	7	7	2	14.23-187.48	100.86	100.86
Residents	16	16	5	24.00-2556.00 3/	199.40	615.97
Safety	1	1	1	3029.00 4/		3029.00

1/ Urine 1-naphthol residue analysis; lowest level detectable by this method is 10 parts per billion (ppb)

2/ From Draft Interim Report, Measurement of Exposure to the Carbamate Carbaryl: Maine Carbaryl Study, 1979. South Carolina Epidemiologic Studies Center, Medical University of South Carolina, November 1979. (used by permission of EPA)

3/ The 2556.00 figure is probably due to the use of a home garden dust containing carbaryl.

4/ 12 to 24 hours after a second intense dermal exposure

The same study indicated that persons entering spray blocks more than 24 hours after carbaryl application would probably have 5 percent or less chance of receiving detectable exposure to carbaryl (personal communication, Dr. Sandifer, South Carolina Epidemiologic Studies Center).

As expected, results from 1978 and 1979 studies in Maine indicate that while precautions can be taken to reduce the number of people exposed and the amount to which they are exposed, it is not possible to avoid exposing some people to carbaryl during the spray operation. However, the amount of carbaryl is extremely small.

During the 1980 spruce budworm spray project the Maine Department of Human Services, Division of Health Engineering monitored carbaryl levels at four locations in Maine (Maine Department of Human Services 1980). The monitoring program had three objectives: 1) perform limited environmental air monitoring; 2) estimate typical carbaryl exposure to residents of the Spruce-Fir Protection District and adjacent populated areas in northeastern Maine; and 3) correlate air monitoring data with data collected by US EPA in 1980 and with data collected in 1978 and 1979 by a Medical University of South Carolina-US EPA team.

The Maine Department of Human Services 1980 study showed carbaryl was detectable at all monitoring sites during spray application periods and, on some occasions, several days later. Carbaryl concentrations ranged from 0.010 ugm/M^3 1/ at the Portage monitoring station on June 14, 1980 to 0.089 ugm/M^3 at the Millinocket station on June 8, 1980. On several days during the monitoring period, various stations reported no detectable drift (<0.010 ugm/M^3). Attempts to correlate detectable carbaryl levels, spray block treatment sequences, and air movement patterns were unsuccessful. However, the carbaryl detected was attributed to 50 to 100 mile drift from spruce budworm spray blocks.

The occurrence of long range carbaryl drift was attributed to the dispersal pattern of the droplet spectra produced by spray application. It was hypothesized that minute droplets (less than 10 um in diameter) remained in the atmosphere for more than one day.

Using air monitoring data, estimated daily intake of carbaryl was calculated for four groups of residents, adult males, adult females, children, and infants, based on differences in inhalation rates. The potential maximum daily intake of carbaryl from long range drift was calculated to be 0.67 micrograms per day during the spray period. Based on these calculations the maximum intake occurred in the adult male group. The other groups experienced lower exposures due to generally lower inhalation rates.

1/ ugm/M^3 = Microgram of carbaryl per cubic meter of air sampled.

The estimated maximum inhalation intake of carbaryl through exposure to long range drift was compared to the normal daily dietary intake of carbaryl as determined by USDA market basket surveys. The maximum inhalation intake was also compared to the Joint Food and Agriculture Organization/World Health Organization standards for daily intake of carbaryl in the diet. The maximum inhalation exposure of 0.67 micrograms of carbaryl was 1/1000 of the allowable daily intake of carbaryl recommeded by FAO/WHO and was equivalent to the maximum daily dietary intake of carbaryl as determined by USDA market basket surveys. The uptake rates and effects of carbaryl may be different depending on whether carbaryl is ingested or inhaled.

Data on carbaryl levels detected by the Maine Department of Human Services in 1980 could not be correlated with air monitoring data collected by US EPA in 1980 due to unequal sensitivity of measuring devices used by the two agencies. However, comparisons were made with data collected in 1978 and 1979. Carbaryl levels detected in the 1980 study 50 to 80 miles from spray blocks and several days after treatment were similar to levels detected one to two miles from spray blocks in 1978 and 1979.

There are several items that were not addressed in the study by the Maine Department of Human Services. The assumption is made that all the detectable carbaryl drift came from the spruce budworm spray project. However, carbaryl residues may come from other sources as well. Carbaryl is the active ingredient in several products registered for control of other pests active during the spray project so that some residues may have resulted from other spraying. No pre- or post-spray ambient air sampling was done to determine background levels of carbaryl. The data show little clear correlation between wind from spray blocks and carbaryl residue detection. This could be expected since long range drift of minute particles is extremely complex and difficult to analyze. The assumption was also made that carbaryl, the active ingredient of Sevin 4 Oil, is the chemical detected at the four monitoring sites. The instrumentation available for such studies is unable to differentiate between carbaryl and its less toxic metabolite, 1-naphthol, at low concentrations. It is possible that the majority of the detected residues were comprised of 1-naphthol. which had been degraded from carbaryl while in the air. This is significant since 1-naphthol has lower mammalian toxicity than carbaryl.

Several factors make assessment of any effects of exposure to carbaryl residues at the 0.67 microgram per day level difficult, as stated in the study: 1) carbaryl residues in our daily diets as determined by USDA market basket surveys approximate the dosages received from drift in this study; 2) exposure may be to both carbaryl and its less toxic breakdown product 1-naphthol; 3) rates of absorption may differ between ingested and inhaled carbaryl residues; and 4) other sources of carbaryl residues exist in addition to the spruce budworm spray project and dietary intake. However, no effect has ever been shown at these levels.

About 2,000 loggers and other woodsworkers are in Maine's Spruce-Fir Protection District during spray projects. As a precaution they are advised to leave spray areas at the time of treatment. Any exposure would be indirectly caused by drift or residues in areas previously treated. Some persons pursuing outdoor recreation are also in the District. They are notified of the spray operation through posters and other means. However, it is possible that some could be in the spray blocks at the time of application.

Carbaryl may be ingested by drinking contaminated water. The no-adverse effect level recognized by the National Research Council (1977) is 574 ppb including a safety factor of 100 and based on an allowable daily intake of 0.082 mg/kg. Concentrations of pesticides in water from aerial application depend on application rates and water volume. The concentration in water is higher in shallow waters and lower in deep waters.

As a practical matter all of the insecticide would not fall in the streams. Much will be caught in foliage above the streams. Trees within a distance of their height to water surfaces filter out 70 to 80 percent of the spray (Maksymiuk 1963). On the other hand, if swaths overlap the concentration could be higher.

On the 1979 Maine spruce budworm suppression project, spray pilots were instructed to cut off spray when crossing water visible from the spray aircraft, as well as to protect streams designated on spray maps, leaving a buffer strip untreated.

The highest concentration of carbaryl in water found in the 1979 spruce budworm control project was 32 ppb 24 hours after spraying (with buffering) a level far below the no adverse effect level recognized by the National Research Council above. The concentration of carbaryl was 15 ppb after 48 hours and 0.6 ppb after 6 days (personal communication E. Richardson, Maine Department of Public Health). Residues of 80 ppb were found within 24 hours in streams directly sprayed with 1.0 lb carbaryl/acre in Maine (LOTEL 1977). After a spray project with 0.5 lb carbaryl/acre in Minnesota, a sample from a beaver pond contained 3000 ppb (Millers 1976). Thus, in the worst case, residues in small streams or ponds sprayed directly with carbaryl could reach 5 times the suggested safe level for a brief period.

Gibbs et al. (1980) sampled carbaryl residue in two ponds directly sprayed with 0.75 lb carbaryl/acre in Maine. Residue level on the surface of one treated pond was 733 ppb immediately after spraying. This was the highest level detected during the sampling. Carbaryl levels at the surface of the same pond was 60 ppb on the following day and decreased to about 5 ppb by 32 days post-spray. Residues were less below the surface of the pond. Residues were lower on the second pond both at and under the surface. Stanley and Trial (1980) studied the rate of carbaryl disappearance from brooks, streams, and rivers in Maine and developed disappearance constants. The half-life of carbaryl was determined to be 25 hours for all streams, indicating that about half of the residue remaining disappeared each day.

Considering settlement area corridors, buffers around water courses and buffers around municipal water supply intakes, exposure of humans in non-target areas to carbaryl through drinking water, if it occurs, will be in such small amounts that risk of adverse effects is negligible.

Persons entering spray blocks soon after application may be exposed to small amounts of carbaryl residue on plants. The insecticides being considered for use are considered non-persistent and break down in a few days. A summary of useful data concerning residues is found under discussion of insecticide residues.

Carbaryl is applied to strawberries at 2.0 lb/acre and potatoes at 1.0 or 2.0 lb/acre (depending on the pest). The pre-harvest interval for carbaryl is 1 day for strawberries and 0 for potatoes (USDA 1979). Until recently the U.S. Dept. of Labor's safe re-entry time (pre-harvest interval) after spraying with carbaryl was 40 days for 10- and 11-year old children harvesting strawberries and potatoes. In preparing this pre-harvest interval requirement, the Dept. of Labor reviewed existing scientific literature relating to the toxicity, environmental degradation, and residue dynamics of carbaryl. The review did not disclose any research directed specifically to effects of carbaryl on 10- and 11-year old hand harvesters. Based upon the absence of specific research data, the Dept. of Labor chose to add additional safety factors exceeding those standards established to protect adults form adverse effects (U.S. Dept. of Labor 1979). However after lengthy judicial and departmental review of re-entry times for 10- and 11-year old children engaged in hand harvesting the Dept. of Labor issued a final ruling on August 14, 1980 regarding waiver provisions for these harvesters. The Dept. of Labor concluded that no minimum entry times for 10- and 11-year old hand harvesters can be established because there is no scientific data or methods available to show that pesticides can be used in crops with absolute assurance of safety to harvesters (Ellsburg 1980). The Dept. of Labor action was based on a February 15, 1980, decision by the U.S.

Court of Appeals for the District of Columbia Circuit that regulations published previously were invalid. The court ruled that absolute proof of no adverse health effects from pesticides on 10- and 11-year old children must be provided in order to establish minimum entry times.

The use of Sevin 4 Oil for spruce budworm control in Maine during previous years has been described as having "had an outstanding record as far as the health and safety of the 100 man crew assigned or hired for the project" (personal communication, Ernest Richardson, Maine Department of Human Services).

Trichlorfon (Dylox 4®)

Trichlorfon is on the Environmental Protection Agency's RPAR candidate list. The reasons listed are: possible oncogenicity (causing tumors) in mice, teratogenicity in rats, mutagenicity in microorganisms; possible bone marrow effects.

The oral LD_{50} for rats is comparable to that of carbaryl. The LD_{50} is 630 mg/kg for male and 560 for female rats. If trichlorfon is a teratogen, it does not appear to be a potent one. Staples and his associates (1976) found positive results in rats, but only at high doses - 432 or 519 mg/kg - none at 145 mg/kg. Martson and Voronina (1976) found embryotoxic and teratogenic effects in rats from an 80 mg/kg dose administered during a critical period of embryogenesis. Effects were absent at 8 mg/kg which is 50 times the highest dose man is expected to receive during a spruce budworm aerial application project.

No authoritative allowable limits in drinking water for trichlorfon are available. The Department of Health, Education and Welfare set limits for organophosphates in general at 100 ppb (U.S. Public Health Service 1968). The allowable residue for trichlorfon in most foods -beans, for example- is also 100 ppb (Chemagro 1972), so 100 ppb seems an appropriate maximum allowable for trichlorfon in water. If trichlorfon is applied in Maine, residues in some water might exceed 100 ppb by several times, but only for a few days. Devine and Willcox (1972), after application of trichlorfon in New York for gypsy moth control at 0.5 lb trichlorfon/acre, found 400 ppb in a lake which degraded to below the limit of detection (<20 ppb) in 5 days. Stream residue was 84 ppb but also reached undetectable levels in 5 days. After a 1.0 lb trichlorfon/acre application in New York for gypsy moth control Weiss and co-workers (1973) reported trichlorfon was undetectable at a much lower limit of detection (<1 ppb) after 15 days. After a 1.0 lb trichlorfon/acre application in Maine for spruce budworm control, Richardson (1976) reported trichlorfon was undetectable in streams (<1 ppb) after 65 days. In a lake adjacent to a spray block, no trichlorfon residues were found until 5 days after spraying. Runoff from the spray block resulted in peak lake water residues 11 days (910 ppb) and declined to 250 ppb 13 days after spraying (Dube 1978).

Trichlorfon is not a mammalian cholinesterase inhibitor but its metabolite, dichlorvos, is (Reiner et al. 1975). Dichlorvos is a registered product for use in controlling household pests. The amount of trichlorfon degrading to dichlorvos is pH dependent. Only a very small amount of trichlorfon is converted to dichlorvos at pH 6.0. At this level trichlorfon is 30 times more stable than at pH 7.4 (Reiner et al. 1975). Since trichlorfon is applied as an acidic formulation for spruce budworm control, there should be no adverse effects attributable to the small quantity of dichlorvos that may be formed.

Trichlorfon is reported to have a potentiation effect on the insecticide azinophos-methyl (Guthion®) (Marking and Mauck 1975). That is trichlorfon causes azinophos-methyl to have a more serious effect. Azinophos-methyl is applied to blueberries to control fruit maggots. If trichlorfon were also used in blueberry areas because of its low toxicity to bees, a potentiation hazard would exist. However, azinophos-methyl is not applied until late June which is after insecticides must be applied to control spruce budworm (USDA 1979). Furthermore, if trichlorfon is used at all, it will be applied using buffers around blueberry production areas.

Acephate (Orthene Forest Spray®)

Acephate is less toxic to mammals than either carbaryl or trichlorfon. The oral LD_{50} of the technical material for female rats is 866 mg/kg of body weight. For Orthene Forest Spray, the oral LD_{50} is about 1,500 mg/kg. The dermal LD_{50} is greater than 2000 mg/kg, but the material may cause skin irritation (Chevron 1975).

Willcox and Coffey (1977) compiled a review of the impact of acephate on the environment including human exposure. Occupational exposures of several workers in a plant producing acephate and in a formulation plant were studied by Pack (1972a). Concentrations of acephate and its metabolites were detected up to 5 ppm in the urine of the workers. Blood cholinesterase levels remained unaffected at this concentration (Pack 1972a).

In a field study, Pack (1972b) monitored research workers exposed to acephate. Urine analysis showed exposure levels to acephate were much less than those of the plant workers.

No health problems have been demonstrated in the various field development programs using acephate. When handled properly acephate poses no health hazard to persons formulating, spraying, or working in sprayed forests (Willcox and Coffey 1977). Orthene Forest Spray is being tested for viral enhancing qualities at the University of Maine, Orono. No results of these tests are presently available.

Acephate breaks down rapidly in soil, but relatively slowly in water. The half-life in water at pH 7 and 70°F is about 50 days under laboratory conditions. In actual use, aquatic vegetation and microorganisms in sediment accelerate the degradation rate (Chevron 1975).

Rabeni and Gibbs (1979) found 135 ppb and 113 ppb in 2 streams 1 hour after spraying 0.5 lb acephate/acre. After 1 day these concentrations dropped to 13 ppb and 65 ppb respectively. Acephate is an organophosphate and presumably the 100 ppb limit set for organophosphates in drinking water by the U.S. Public Health Service (1968), is applicable. The established tolerance for milk, eggs, and meat is also 100 ppb. Data collected to date and discussed above indicate that acephate levels in the water in areas sprayed for budworm control in Maine, will exceed 100 ppb, but only for a brief period.

From kinetic reaction studies, it has been determined that about 5 - 10 percent of acephate degrades into methamidophos. The remaining acephate degrades directly into innocuous salts (Tucker 1972). No other metabolites of toxicological significance have been observed (Tutass 1968). Methamidophos is itself a registered insecticide for use on certain lepidopterous larvae. Furthermore, the chemical is rapidly degraded in soil (Leary and Tutass 1968) and poses no threat for bioconcentration (Chevron 1973).

Acephate seems to be a safe insecticide to use for spruce budworm control. No threat to human health is apparent.

Bacillus thuringiensis (Bt) (Thuricide® and Dipel®)

Bt has been found to be harmless to mammals. There is no indication that Bt harms humans (Fisher and Rosner 1959).

AQUATIC INVERTEBRATES

Due to the sensitivity of certain aquatic invertebrates species to insecticides and the likelihood that buffers will not be entirely effective in completely eliminating contamination, some aquatic invertebrate populations will be reduced temporarily by insecticide treatment, particularly with carbaryl. The duration of the effects is not fully known, but some long term (more than 1 year) effects on populations of a few species of aquatic invertebrates is anticipated, particularly in the areas sprayed with carbaryl in two or more consecutive years.

Experience on past spruce budworm suppression projects in Maine has shown that even when great care is taken some insecticide will reach aquatic areas. Some small streams and ponds cannot be avoided and will receive direct application although this is usually considerably reduced by the filtering action of trees and other plants. Some insecticide residues will reach streams in runoff (EPA 1977).

Limited studies of the effectiveness of an extensive buffer network around water used for the first time in 1979 indicated that less water contamination occurred in 1979 than in previous years (McCullough and Stanley 1980, Trial 1980). Peak stream water residues in both studies were generally below 2 ppb. In comparison 20 to 70 ppb were detected in unbuffered streams (Gibbs et al. 1979).

Insecticide applications may cause populations of one or more species in some streams to suffer long term reductions (more than 1 year). If long term population reduction occurs, it would probably be greatest for stoneflies and some mayflies. Most other insects have a greater recovery capability and should suffer only short term population reductions.

Fish depend on stoneflies and mayflies for a portion of their diets. Response of fish to increased insect drift in streams has been studied in Maine. Results of several studies are discussed later under Fish. Stoneflies play an important role in the process of leaf shredding. The possible consequences of stonefly mortality on the rate of leaf shredding was begun in Maine in 1980, but the results are not yet available (Trial 1980).

Studies of effects of split applications of carbaryl (two applications totaling no more than 1 lb/acre) suggest reduction of aquatic insect populations is no more severe than that associated with single applications of carbaryl at 0.75 lb/acre. However, no definitive studies have been done to compare effects of single application versus split applications.

Carbaryl (Sevin 4 Oil®)

Some aquatic insects in the orders Plecoptera (stoneflies) and Ephemeroptera (mayflies) are known to be highly sensitive to low levels of carbaryl. Trichoptera (caddisflies) and Diptera (true flies) are also sensitive to carbaryl. A 50 to 100 percent reduction in aquatic insect populations may occur in treated streams and ponds (Burdick et al. 1960). LOTEL (1977) reported that in a stream treated with 1.0 lb carbaryl/acre, each sampling station recorded a residue of at least 40 ppb and a peak residue of 80 ppb. The biological impact was indicated by increased drift of dead and dying stoneflies, mayflies, caddisflies, and true flies.

Gibbs and co-workers (1979) studied effects of an initial application at 0.31 lb carbaryl/acre followed by a second application at 0.69 lb carbaryl/acre. Exposure to the first treatment yielded the largest number of drifting dead and dying aquatic insects, the second treatment yielded the greatest number of genera in the drift.

In the same study peak stream water residue was 8.5 ppb. Biological response to this level of insecticide included increased drift of stoneflies, mayflies, caddisflies, and true flies, and 34 percent mortality of caged caddisfly larvae compared to 4 percent in control streams (Gibbs et al. 1979).

In a treated (0.31 lb carbaryl/acre) pond yielding a peak residue of 5.7 ppb distressed mayfly nymphs (Siphlonurus sp.) and caddisfly larvae (Limnephilus sp.) were observed within 2 hours of spraying. After 3 days the average survival of caged mayfly nymphs was 20 percent in treated ponds compared to 70 percent in untreated areas. Similarly caged caddisfly larvae averaged 30 percent survival in treated ponds compared to 90 percent in untreated ponds (Gibbs et al. 1979).

A pond treated with 0.75 lb carbaryl/acre yielded water residues less than 5 ppb. This level of exposure reduced populations of Gammarus sp. (Amphipoda) to zero and caused caddisfly (Limnephilus sp.), mayfly (Arthroplea sp.) and midge (Chironomidae) mortality (Courtemanch and Gibbs 1978).

Crayfish (Cambarus sp.) mortality has been associated with application of Sevin 4 Oil in Maine (Trial and Gibbs 1978, personal communication, D. Courtemanch). No studies have been done in Maine specifically examining the relationship between crayfish and carbaryl, but such a study is planned by the Maine Bureau of Forestry for 1981.

Pimentel (1971) and the U.S. Environmental Protection Agency (1977) summarized results reported by several workers who carried out laboratory tests on the effects of carbaryl on various organisms including crustaceans and mollusks. A relatively high sensitivity of fresh water crustaceans (crayfish, amphipods, and waterfleas) to carbaryl has been found in laboratory tests. Mollusks (oysters, clams, and mussels), on the other hand have been far more resistant to carbaryl. Young crayfish have had a greater sensitivity to carbaryl

than older crayfish in laboratory tests. Although laboratory tests indicate a sensitivity of some marine crustaceans to carbaryl, there appears to be little if any danger of significant concentrations of carbaryl reaching marine habitats as a result of use of carbaryl for spruce budworm control.

Several studies have detected long term effects on fresh water arthropod populations. LOTEL (1977) reported stonefly population levels were depressed 1 year after treatment with 1.0 lb carbaryl/acre. Trial (1978, 1979) reported altered stonefly generic assemblages in streams 1 to 2 years after treatment, and reported that populations of mayfly species in the genus Lithobrancha were reduced to zero after 1.0 lb carbaryl/acre application, and 2 years elapsed before recolonization in one of two treated streams. Courtemanch and Gibbs (1978, 1979) found that in ponds, populations of Gammarus sp. were reduced to zero in 1977 and not observed the following year. Gammarus sp. populations were reduced to zero in two ponds experimentally treated with carbaryl in 1980 (personal communication, K.E. Gibbs). A short and long term impact study by Courtemanch and Gibbs (1980) of streams treated 1 or 2 years with carbaryl indicates the effect on invertebrate communities may last two or more years. Initial postspray (2-day) drift in streams treated once increased 170 times. In streams treated twice some species especially within Ephemeroptera and Plecoptera, may recolonize slowly. The amount of long term impact appears to be a function of species susceptibility and recolonization ability. Two consecutive years spraying with carbaryl reduced populations of stonefly and susceptible mayfly genera to near zero.

The effects on other aquatic organisms appear similar to those observed in areas treated just once (Trial 1978, 1979, Courtemanch and Gibbs 1979). Effects of two consecutive years of spraying include loss of stonefly species or families from individual streams, and altered generic assemblages for an indefinite period (Trial 1978, 1979). A study of buffered streams by McCullough and Stanley (1980) during the 1979 Maine spruce budworm spray project, indicated that benthic invertebrate fauna were not adversely affected. Also, the numbers of drifting invertebrates were substantially lower than in previous years.

The long term effects, if any, of reductions in these organisms or other organisms, with the exception of fish, and on biological processes are not known. A study of the effects of a reduction of stonefly population by carbaryl application on the process of leaf shredding in Maine streams was begun in 1980 and will continue in 1981 (Trial 1980). Methodologies were developed for studying this process but no conclusion can yet be drawn from the data.

Trichlorfon (Dylox 4)

Trial and Gibbs (1978) observed increased drift of dead stoneflies in a Maine stream treated with trichlorfon, but only in the 24 hour postspray sample. Other aquatic insects appeared to be unaffected. They concluded that trichlorfon has less impact on aquatic insects than carbaryl. Laboratory bioassays indicate that trichlorfon is

approximately 1/10 as toxic to stonefly nymphs as carbaryl (Sanders and Cope 1968). An application rate of 1.0 lb trichlorfon/acre in New York caused large drift increases of Collembola (Todaro and Brezner 1973). When Dylox was used in coastal Washington County in 1977 soft shell clams, Mya arenaria L., were sampled for residues from the intertidal areas of Whiting Bay. No Dylox residues (<5 ppb) were detected 5 or 10 days after spraying, water residues were not measured (Flagg and Hurst 1978).

Acephate (Orthene Forest Spray)

Trial and Gibbs (1978) concluded that the impact of acephate on aquatic invertebrates is minor compared with carbaryl. Bocsor and O'Connor (1975) reported that a 0.5 lb acephate/acre application resulted in decreased populations of caddisflies and true flies, and that the decreases were temporary and significant only for midges. A similar application in Maine resulted in decreased populations of caddisflies and mayflies, but reductions were temporary and no longer detected 9 days after treatment (Rabeni and Gibbs 1979).

Bacillus thuringiensis (B.t.) (Thuricide and Dipel)

This insecticide has the least impact on aquatic organisms of the insecticides being considered for use. Bt is a Lepidoptera (moths and butterflies) specific insecticide. In Canada an aerial application of Bt resulted in a sharp increase of adult mayflies collected in stream drift samples (Buckner et al. 1974). The investigators concluded that the effect was physical rather than biological i.e., the treatment physically knocked adults into the stream.

FISH

Expected effects on fish from the use of chemical insecticides being considered include temporary depression in brain acetylcholinesterase activity and a change in feeding habits and diet associated with kill of aquatic insects and terrestrial arthropods. There are no known long term effects on fish or fish fry populations from insecticide application on Maine's spruce budworm suppression projects. The only short term effect observed was the lowering of acetylcholinesterase but never to critical levels; in fish these levels are quickly regenerated (personal communication, Jon Stanley, University of Maine, Orono). No trends have yet been observed in fish populations in Maine that can be attributed to use of insecticides for spruce budworm suppression. Normal population fluctuations occur, but these can be attributed to changes in water conditions (personal communication, Lyndon H. Bond, Biologist, Maine Department of Inland Fisheries and Wildlife). Mortality of fish (stickleback) attributed to budworm spraying has been reported once in Maine (Courtemanch and Gibbs 1978).

Buffers are used around all streams and lakes determined to be "Critical Fisheries." Limited studies of Maine's extensive network of buffers, first used in 1979 for reducing water contamination,

indicate that less water contamination occurred than in previous years (personal communication, Joan Garner Trial).

Carbaryl (Sevin 4 Oil)

During operational spraying in Maine (1.0 lb carbaryl/acre) acetylcholinesterase depressions averaged 20 percent for brook trout (Salvelinus fontinalis Mitchill) and 35 percent for Atlantic salmon (Salmo salar C.) (Hulbert 1978). These depressions were detected within 24 hours of spraying and persisted throughout the sampling period (192 hours). During spruce budworm spraying in Maine (1.0 lb carbaryl/acre) in 1975, brook trout depressions ranged between 13 and 22 percent and returned to normal within 48 hours. Activity depressions in Atlantic salmon were more gradual (9 - 27 percent) and failed to return to normal within the same sample period (48 hours) (Marancik 1976).

In response to double carbaryl applications (0.31 and 0.69 lbs. carbaryl/acre) brook trout exhibited a slow, delayed drop in acetylcholinesterase activity after the first treatment (Gibbs et al. 1979). These depressions were short-lived since 30 day samples revealed no significant differences between treated and untreated samples.

Exposure to split applications of carbaryl decreased oxygen consumption by brook trout (Gibbs et al. 1979). However Brown (1980) concluded split applications of carbaryl had no apparent effect on oxygen consumption by brook trout.

White suckers (Catastomus commersoni Lacepede) responded to carbaryl exposure with increased brain acetylcholinesterase activity levels (Marancik 1976, Hulbert 1978). Marancik (1976) reported that tissue analyses of Atlantic salmon, eastern brook trout, and the slimy sculpin (Cottus cognatus Richardson) yielded no carbaryl residue in any of the fish species 24, 48, and 168 hours after exposure to an application of 1.0 lb/acre of carbaryl.

Large numbers of dead juvenile and a few dead adult nine-spined sticklebacks (Punigitius punigitius L.) were observed in one area during operational spraying in Maine of 0.75 lb carbaryl/acre, in 1978 (Courtemanch and Gibbs 1978). These effects were observed in shallow pools where insecticides would be expected in higher concentrations than in fast moving or deep water. The following year adult and young-of-the-year sticklebacks were present in this area (Courtemanch and Gibbs 1979). Whether carbaryl caused the mortality in 1978 is uncertain since such mortality has not been found before or since. The following year caged adult sticklebacks were unaffected by split (two) applications of 0.31 and 0.69 lb carbaryl/acre (Gibbs et al. 1979).

Brook trout in Maine responded to increased insect drift by increasing the numbers and volume of prey taken per fish (LOTEL 1977, Hulbert 1978, Gibbs et al. 1979). Increased feeding activity persisted 2 to 4 days then returned to prespray levels. In multiple applications, (two applications totaling 1.0 lb carbaryl/acre) fish feeding increased after the first application but not after the second (Gibbs et al. 1979). Increased feeding may not enhance fish productivity, since there are indications that subsequent feeding declines later in the season (Gibbs et al. 1979).

A study of buffered streams by McCullough and Stanley (1980) during the 1979 Maine spruce budworm project, indicated that feeding and acetylcholinesterase activity of young-of-the-year brook trout were not adversely affected. Ott and Wilder (1980) studied the effects of an application of 0.75 lb carbaryl/acre on young brook trout in one unbuffered and one buffered stream in Maine. No physiological changes in brook trout were detected that could be attributed to carbaryl contamination. In addition, these workers concluded that it is extremely unlikely that streams accidentally contaminated by carbaryl during spraying for spruce budworm control in Maine would have fish mortality.

A quantitative change in river brook trout diet from fish and oligochaetes (segmented worms), to stoneflies, mayflies, and larval flies persisted approximately 4 days after a 0.75 lb carbaryl/acre application (Hulbert 1978). This change in fish diet is expected because rock-clinging stoneflies and mayflies exposed to insecticides become free floating and are thus more available as fish food. Increased stonefly feeding after carbaryl application was also reported in stream brook trout (LOTEL 1977). Terrestrial prey became more abundant food items for brook trout two weeks after application in Maine (LOTEL 1977).

Coexposure of trout to a nonlethal concentration of carbaryl increased the acute toxicity of 2,4-D butyl ester, dieldrin, rotenone, and pentachlorophenol (Statham and Lech 1975). The only one of these likely to be used extensively in Maine is 2,4-D (as amine salt, rather than the ester form) which has been used to control forest vegetation in regeneration areas. Although some 2,4-D from vegetation control applications may get into streams flowing through or adjacent to the areas being sprayed with carbaryl, monitoring of spray operations in western Oregon over a 6-year period showed that phenoxy herbicide residues never exceed 0.1 ppm in the adjacent streams (Norris and Moore 1971). Normally the requirement to leave buffer strips of untreated areas along streams decreases water contamination to less than 0.01 ppm (Newton 1979). These levels of 2,4-D are orders of magnitude lower than the LD_{50} level of 11 ppm found by Statham and Lech (1975).

Trichlorfon (Dylox 4)

Laboratory bioassays revealed sub-lethal effects of 5 ppm trichlorfon exposure to rainbow trout larvae including behavioral modification, depressed brain acetylcholinesterase activity, and pathological

degeneration of body tissues (Matton and LaHam 1969). Fish toxicity increased the longer trichlorfon remained in water (represented by formation of DDVP) and a synergistic effect was observed in combination with azinophos-methyl (Marking and Mauck 1975).

No significant difference in acetylcholinesterase activity was found between smallmouth bass collected before and after spraying with trichlorfon for spruce budworm control in Maine (Dube 1978).

Fish tissue residues peaked 12 to 24 hours after a 1.0 lb trichlorfon/acre application and were at or below detectable limits (<0.02 ppm) after 96 hours (Finger and Werner 1973). Stream fish tissue residues were approximately 10 times higher than lake fish residues reflecting higher trichlorfon concentrations in stream water. Trichlorfon as Masoten® is registered for fish parasite control when applied at 0.5 lb trichlorfon/acre foot of water.

Available evidence indicates that applications of up to 1.0 lb trichlorfon/acre have little significant adverse effects on fish.

Acephate (Orthene Forest Spray)

Laboratory bioassays indicate that acephate is relatively non-toxic to fish and lethal dosages are far greater than could be expected during operational application (Schoettger and Mauck 1976). Acephate was the least toxic of six candidate forest insecticides (Sumithion®, Matacil®, Dylox, Sevin, Dimilin®) to brook trout and Atlantic salmon. The investigators also concluded that for these insecticides acephate was the least toxic to stream invertebrates upon which fish depend for food.

Acephate application may result in alteration of fish feeding habits (Rabeni 1978). Quantitatively there is an immediate post spray increase of number of prey and prey volume taken per fish. The number of terrestrial forms (beetles, moths, wasps, and particularly spiders) also increased postspray and lasted 2 to 3 days before returning to prespray levels. Prey volume per fish however, remained above prespray levels throughout this study (8 days).

Acephate exposure depressed brain acetylcholinesterase activity in white suckers 28 to 29 percent postspray, and activity returned to prespray levels in 8 days (Rabeni 1978). Acetylcholinesterase activity was not depressed in brook trout or Atlantic salmon.

Bluegill sunfish (Lepomis macrochirus Rafinesque), yellow perch (Perca flavescens Mitchill), small mouth bass (Micropterus dolomieui Lacepede), and bullheads (Ictalurus nebulosus LeSeur) were caged in a pond and observed for 2 weeks before and after an application of 0.5 lb. acephate/acre. No mortality or behavioral changes were observed among the caged fish. No residues were detected in fish tissues or bottom sediment, and only 0.01 ppm acephate was deteced in water samples immediately after spray (Bocsor and O'Connor 1975).

Available evidence indicates that there would be little, if any, adverse effects on fish from the use of acephate to control spruce budworm.

Bacillus thuringiensis (Bt) (Thuricide and Dipel)

No data is available but no adverse effects are expected.

BIRDS

Expected effects on birds from chemical insecticides being considered for use include short term reductions in brain acetylcholinesterase activity and movement out of treated areas in response to temporary depletion of food supply. At the rates of application planned there appears to be little chance of reduction in bird populations. Long term effects on birds, if any, of repeated exposure to these insecticides have not been studied in Maine.

The risk of insecticide exposure to two endangered bird species, American peregrine falcon and arctic peregrine falcon, appears to be negligible. These birds would most likely be found near coastal areas far from the insecticide application. A third endangered species, the bald eagle, is found in and near some of the area being considered for insecticide application. The precaution planned to protect eagle nesting sites is to buffer known nesting sites on all sides. The principal reasons for buffering these sites are to avoid disturbing the birds with noise from low flying aircraft, and uncertainty about the potential long term effects from repeated insecticide exposure to these long-lived birds. A 1/2 mile buffer on all sides of the nesting site is considered adequate for their protection (personal communication, Frank Gramlich, US Fish and Wildlife Service). Nesting sites have been identified by wildlife agencies.

Carbaryl (Sevin 4 Oil)

Although depressed brain acetylcholinesterase activity of forest birds was reported following application of 1.0 lb carbaryl/acre in Montana (Zinkl et al. 1977), split treatments (0.31 and 0.69 lb carbaryl/acre) in Maine revealed no depression (Gramlich 1979). Observations by Connor (1960) on 49 species of birds exposed to carbaryl failed to reveal any adverse effects on their behavior, conditions, or reproduction and rearing of young.

A study of breeding birds response to an aerial spray of carbaryl by Zinkl et al. (1979) reported no significant effects on the numbers of breeding birds, nest success, mortality rates, or the activities of brain cholinesterase.

An indirect effect of carbaryl spraying on the forest may be a depletion of available food which consequently alters bird activity (Doane and Schaefer 1971). The investigators felt that nestlings may be particularly affected in large spray blocks. They also pointed out the need for more study of the bird-insect control relationship.

Split applications totaling 2.0 lb carbaryl/acre in New Jersey resulted in a gradual decline in numbers and diversity of songbird communities (Moulding 1972). These effects persisted through the following year

and could represent: (1) opportunistic feeding outside the treated area, (2) reduced reproductive success, or (3) shift in nest site loyalty.

In Maine in 1980 the possible indirect effects of carbaryl use for spruce budworm suppression on bird behavior was studied (Hunter 1980). Although results indicated some species may be perturbed by carbaryl spraying, small sample size and unusually cool weather made the results difficult to interpret.

Trichlorfon (Dylox 4)

Aerial application of 1.0 lb trichlorfon/acre in Maine depressed brain acetylcholinesterase activity within 24 hours for evening grosbeaks, (Hesperiphona vespertina Grinnell), flycatchers (Epidonax spp.), and baybreasted warblers (Dendroica castanea Wilson)(Peterson 1976).

An application of 1.0 lb/acre of trichlorfon in New York resulted in movement of foraging activities to outside treated areas for 5 weeks (Caslick and Cutright 1973). This response represented depletion of available arthropod food supply since nesting activities were uninterrupted in treated areas. Trichlorfon residues in bird tissue were commonly detected from control as well as treated areas (Chambers 1972).

Acephate (Orthene Forest Spray)

Acephate exposure has not been associated with forest bird mortality (Buckner and McLeod 1975; May 1978). However singing activity of the crested flycatcher (Myiarchus crinitus (L.) declined and 2 Vireo species abandoned treated areas after spraying (Bart et al. 1975). These reactions are considered responses to arthropod food supply distribution.

Two forest songbird species which inhabit the forest canopy exhibited significant brain acetylcholinesterase activity reductions following 0.5 lb acephate/acre exposure in Maine (Julin and Gramlich, 1978). These depressions persisted about 5 weeks (Mairs 1978).

Laboratory bioassays with acephate (acute oral and feeding studies) given to dark-eyed juncos (Junco hyemalis L.) suggest that acephate itself is a relatively safe insecticide for passerine birds (Personal communication, J. Zinkl, University Calif. 1979). From this study, it appears that cholinesterase inhibition of about 80 percent is necessary to kill birds, although some birds with lesser inhibitions may die.

Zinkl et al. (1979) found that when acephate was applied at 0.5, 1.0, and 2 lb/acre in eastern Oregon there were widespread and prolonged brain cholinesterase depressions in passerine birds. It is not known whether this exposure caused detrimental subacute effects.

A monitoring study in Oregon by Richmond and co-workers (1978) at 1.0 and 2.0 lb acephate/acre rates indicated that brain cholinesterase depression in birds was severe and prolonged (30 to 50 percent) for up to 33 days. No dead birds were found on plots treated with the 1.0 lb rate but a dead grouse was found on the 2.0 lb treated plot. This may be significant in terms of overall mortality considering the rapidity with which carcasses disappear due to heat, predators, and scavengers (Zinkl 1979, Davis 1970).

In Florida, the 1978 cooperative State-Federal citrus blackfly ground treatment program using acephate (0.5 lb/100 gal. water) was associated with occasional bird mortality in sprayed areas. Blackbirds (Ichteridae) and sparrows (Ploceidae) were affected and residues were detected in dead specimen brain tissues. However, the actual cause of death was undetermined (personal communication, W. Stagner, APHIS, PPQ).

Bacillus thuringiensis (B.t.) (Thuricide and Dipel)

Warbler and sparrow population fluctuations in Thuricide and Dipel treated plots were not statistically significant from those in untreated plots (Buckner et al. 1974). Reduction of lepidopteran larval food items could result in feeding territory alteration.

BEES

Native bees (Apoidea) and honeybees (Apis mellifera L.) used in honey production and blueberry pollination can be killed by certain chemical insecticides. Native bee populations and some apiaries could be adversely affected. However, most of the hives used for honeybee production in Maine are south of the spruce-fir areas usually treated with insecticides.

Experience on past spruce budworm suppression projects indicates that in spite of precautions, there is some risk that a few apiaries will be affected. In 1979, for example, 3 bee kills were reported (personal communication, Maine Bureau of Forestry). Only one of these reports, however, was confirmed as having been caused by an insecticide used for spruce budworm suppression.

Foraging bees are exposed to insecticide residues on recently sprayed plants. Normally exposure decreases with increased buffer width between hives and treated areas. However, a scarcity of pollen or nectar sources may result in bees traveling long distances, some poisoning as far as 3 to 4 miles away from spray blocks may occur.

Carbaryl (Sevin 4 Oil)

Native bees, the most important pollinators in Maine, when exposed to 0.75 lb carbaryl/acre application in one area, suffered at least 50 percent population mortality (Miliczky and Osgood 1979).

The relationship of wild bee mortality to pollination success and fruit yield is not clearly understood. Fruit set of the insect pollinated withe-rod (Viburnum cassanoides (L.)) was reduced by

80 percent in sprayed areas (Miliczky and Osgood 1979). The effect of decreased fruit production from insect pollinated plants on small mammal and bird populations is not known.

The long term impact on wild bee populations is not clear. Vastly improved fruit set of withe-rod the year after treatment was caused by: (1) better weather during the 1978 bloom, and (2) pollinator population recovery (Miliczky and Osgood 1979).

Johansen (1959) reported carbaryl as highly toxic to honeybees. Adverse effects of carbaryl exposure are: (1) heavy bee mortality, (2) reduced pollen and honey collections, (3) queenlessness, (4) colony decline and frequent failure of overwintering colonies (Anderson 1964). Economic losses can be avoided by moving hives prior to spraying and allowing one week before relocation (Strang et al. 1968). Covering hives prior to treatment can also reduce losses (Morse 1972).

Trichlorfon (Dylox)

Johansen (1959) reported that in contrast to carbaryl and acephate, trichlorfon is relatively non-toxic to honeybees, and that bees caged with trichlorfon treated foliage (sprayed two hours previously) sustained only 17 to 18 percent mortality. Trichlorfon residues are not transported by foraging bees from contaminated surfaces into hives as may occur with other chemicals (Gilpatrick and Terrill 1970).

Acephate (Orthene Forest Spray)

Buckner and McLeod (1975) monitored hives during a 1.0 lb acephate/acre application. Bee mortality increased immediately particularly among nurse bees. Heavy mortality continued for two days and pollen collection was curtailed as long as five days. Seasonal honey production was similar for treated and control hives. Laboratory bioassays of worker bees indicate that acephate is slightly more toxic than carbaryl (Chevron 1973).

Bacillus thuringiensis (Bt) (Thuricide and Dipel)

Bt is apparently non-toxic to bees. Cantwell and co-workers (1966) reported no adverse effect after honeybees ingested large quantities of Bt. Hives exposed to Bt field applications exhibited normal flight activity, mortality patterns, pollen and honey accumulation, and seasonal hive weight gain (Buckner et al. 1974).

SMALL ANIMALS

No adverse effects are expected on small mammal populations.

Residue analysis indicates that few mammals escape exposure (Chambers 1972, Stehn and Stone 1975). Sources of exposure are physical contact with residues and consumption of contaminated foliage and prey.

Carbaryl (Sevin 4 Oil)

A 2.0 lb carbaryl/acre application in a semi-enclosed grassland ecosystem did not affect total number of small mammals (Barrett 1968). However, exposure did result in a reduced reproduction rate for cotton rats (Sigmodon hispidus Say and Ord). Other species replaced unoccupied cotton rat niches. The duration of this species replacement response was not determined.

Adverse impacts of operational spraying of carbaryl on abundance, dispersal, and reproduction of small mammal populations were not detected (Connor 1960, Willcox 1972; LOTEL 1977; May 1978).

Trichlorfon (Dylox 4)

Depressed brain acetylcholinesterase activity levels were found in whitefooted mice (Peromyscus leucopus (R) Gloger) after a 1.0 lb trichlorfon/acre application (Peterson 1976). No impacts were detected following a 1.0 lb trichlorfon/acre application in New York (Chambers 1972; Caslick and Smith 1973). No adverse population effects have been observed during previous spruce budworm control projects in Maine.

Acephate (Orthene Forest Spray)

Acephate exposure had no impact on small mammal reproduction, mortality, territorial alteration, or growth rate (Buckner and McLeod 1975, Stehn and Stone 1975). The only exception was the whitefooted mouse population which had fewer numbers trapped, smaller mean body lengths, and smaller mean testes weights one month after application. The duration of these effects was not determined (Stehn and Stone 1975). Mice (P. leucopus (R) Gloger), shrews (Blarina brevicauda Say), and voles (Clethrionomys gapperi Vigors) all utilized the temporarily abundant postspray arthropod food source during a spruce budworm control program (Stehn and Stone 1975).

Bacillus thuringiensis (Bt) (Thuricide and Dipel)

Bt applications with and without chitinase had no detectable impact on small mammal abundance (Buckner et al. 1974). Field mice (Napaeozapus insignis Miller and Peromyscus maniculatus Wagner), shrews (B. brevicauda and Sorex cinereus Kerr), voles, and chipmunks (Tamias striatus L.) were examined and 80 percent of adult females had placental scars, indicating that, even though the sample size was small, reproduction was unaffected.

TERRESTRIAL INSECTS AND SPIDERS

Many insects and spiders inhabit the same general forest environment as the spruce budworm. Some are beneficial because they prey on budworm. Insects and spiders present in the tree crowns will be exposed to a greater amount of insecticide than those that inhabit lower crown levels, ground vegetation or litter, due to tree crown filtration of spray.

Populations of some terrestrial insect and spider species will be reduced as a result of insecticide application. These reductions could persist for more than one year in some cases. No data is available on the long term impact of repeated applications of insecticides on populations of terrestrial insects and spiders.

Carbaryl (Sevin 4 Oil)

Carbaryl is a broad spectrum insecticide and population reduction of non-target insects and spiders is expected. Hardwood forests treated with carbaryl to control the gypsy moth (Lymantria dispar L.) showed reduction of ground beetle (Carabids) populations in Connecticut (Doane and Schaefer 1971) and New York (Dean et al. 1976).

In Maine as a result of carbaryl exposure carabid populations were reduced by half for most of the summer (Hydorn 1979). June beetles (Coleoptera) and fish flies (Neuroptera) were less abundant after carbaryl treatment in New Jersey (Moulding 1972). Collembola reduction was reported in New York where populations were still depressed one year later (Dean et al. 1976). Apanteles spp. parasite reduction has not been detected through annual budworm parasite surveys. The effects on other ichneumonid species is not known.

Effects of carbaryl treatment on spiders in Maine are reported by Hydorn (1979). Both arboreal and terrestrial spider populations were reduced nearly by half.

The ecological effects of population reductions of these terrestrial invertebrates are unknown.

Trichlorfon (Dylox 4)

Trichlorfon, like carbaryl, is a broad spectrum insecticide. Adverse effects are reported from other areas for gypsy moth treatments and from Maine's spruce budworm control. In Connecticut, Sarcophagidae (flesh flies), Tachinidae (no common name) and Hemiptera (true bugs) were reduced by 90 percent after trichlorfon treatment (Doane and Schaefer 1971). Stream drift with large components of arboreal Diptera (true flies), Hymenoptera (ants, wasps, and bees) and Lepidoptera (moths and butterflies) increased after trichlorfon treatment in New York (Todaro and Brezner 1973). In Maine, reduced populations of spiders, moths, butterflies, and tachinids were reported by Simmons (1976).

Acephate (Orthene Forest Spray)

Acephate is another broad spectrum insecticide. Shelby and O'Connor (1975) reported a 2/3 population reduction of Lepidoptera in the crowns of hardwoods following an aerial application of acephate to control gypsy moth. In Maine, Hydorn (1979) reported spider population reductions after spraying with 0.5 lb acephate/acre. Some spider populations were more affected than others, but most were reduced by about one half. Rabeni (1978) reported that a large variety of terrestrial insects are a part of stream drift after spraying with acephate.

Bacillus thuringiensis (Bt) (Thuricide and Dipel)

Bt insecticides are specific to phytophagous lepidopteran larvae. In spruce-fir forests canopy-feeding lepidopterans will be adversely affected. Indirectly parasite-predator complexes could be influenced through host population reduction.

No significant reduction of non-target insect populations in Bt treated areas was detected (Buckner et al. 1974). Decline among ground beetles, millipedes (Diplopoda), and larval lepidopteran populations occurred simultaneously on both treated and control sites and were not considered significant. Hymenopteran spruce budworm parasites were unaffected.

SOIL ORGANISMS

Soil organisms such as earthworms and mites experience less exposure to aerially applied insecticides than other organisms since most insecticide entering forests is deposited in the tree crown and litter layer. Some reduction in populations of soil organisms, however, can be expected from insecticide applications. The impact of repeated exposure to soil organisms resulting from the use of insecticides to control spruce budworm has not been studied in Maine.

Carbaryl (Sevin 4 Oil)

Three weeks after a 2.0 lb carbaryl/acre (formulated as a wettable powder) application earthworm populations were reduced 60 percent in pasture samples (Thompson 1971).

Two applications of 1.0 lb carbaryl/acre applied to a millet field resulted in significantly decreased soil litter decomposition (Barrett 1968). Total arthropod biomass and numbers were reduced 95 percent. Total arthropod biomass recovered to control levels after five weeks, but numbers of arthropods remained suppressed.

Two applications of 1.0 lb carbaryl/acre in aqueous solution suppressed Collembola (springtail) populations (Moulding 1972). Population levels were fully recovered within six weeks.

The effects of carbaryl on soil organisms and indirectly on litter decomposition in Maine's spruce-fir forest are not known.

Trichlorfon (Dylox 4)

Two separate trichlorfon applications (1.0 lb trichlorfon/acre) in New York had no detectable impact on soil organisms (Moore and Willcox 1972, Wang 1973).

Acephate (Orthene Forest Spray)

Acephate applied at 0.5 lb/acre on forests in New York and Pennsylvania yielded very low residues (Moore 1975). These residues degraded rapidly and had no detectable impact on soil bacteria and fungi.

Bacillus thuringiensis (Bt) (Thuricide and Dipel)

No information is available on effects of Bt on soil organisms. Because of its specificity there is little likelihood that there would be any adverse impact.

INSECTICIDE RESIDUES

When insecticides are released into the environment, they may be deposited on plant foliage, litter, soil, water, or non-target organisms, where they remain for varying periods depending on their breakdown rate. A summary of residue persistence on foliage, litter, and soil for carbaryl, trichlorfon, acephate, and Bacillus thuringiensis is found below. Residue persistence in water is discussed earlier under Humans. In field studies the effects of any breakdown products with insecticidal activity are included in the evaluation of the effects of the parent compound.

Carbaryl (Sevin 4 Oil)

Carbaryl is a non-accumulating insecticide of short residual life (EPA 1977). Foliage residues of 2.74 ppm were found after spraying with 0.5 lb carbaryl/acre for spruce budworm control in Minnesota. These declined to 1.14 ppm after 10 days (Millers 1976). The half-life of carbaryl on grasses is 8-10 days (Fairchild 1970). After carbaryl (Sevin 80 WP) was applied to oats at 2.0 lb carbaryl/acre, the residues found were 37 ppm the day after spraying, 3.9 ppm 8 days after spraying, and 1.8 ppm 16 days after spraying (Suttman and Barrett 1979). When 1.0 lb carbaryl/acre was applied in Maine for spruce budworm control, immediate postspray foliage residues of 1.99 ppm were observed. Residues of 1.12 ppm were found after 14 days and after 28 days no detectable residues (<0.02 ppm) remained (LOTEL 1977). The highest carbaryl residue in litter (0.59 ppm) was recorded 7 days after application (LOTEL 1977). Peak pond sediment residues reached 0.77 ppm soon after an application of 0.75 lb carbaryl/acre for spruce budworm control in Maine and persisted for at least one month (Courtemanch and Gibbs 1979).

Trichlorfon (Dylox 4)

Trichlorfon residues on foliage 1 day after an aerial application of 1.0 lb trichlorfon/acre have been found at 226 ppm (Devine and Willcox 1972), 150 ppm (Richardson 1976), and 79 ppm (Weiss et al. 1973). Although most residues declined within a month, 4.5 ppm were present after 20 days (Weiss et al. 1973). None was found on foliage 343 days after treatment (Grimble 1972).

Leaf residues apparently degrade rapidly at first and then more slowly. Devine and Willcox (1972) after application of 0.5 lb trichlorfon/acre in New York for gypsy moth control reported residues of about 100 ppm immediately after treatment. These residues decreased to about 2.0 ppm by 28 days postspray and 1 ppm by 106 days postspray.

Acephate (Orthene Forest Spray)

When acephate was aerially applied for gypsy moth control in New York at 0.7 and 0.5 lb acephate/acre, peak foliage residues at 24 hours were 30.8 and 11.1 ppm respectively (Devine 1975). Residues were 0.21 ppm for the 0.7 lb acephate/acre application on the 18th day after spraying and were undetectable (<0.2 ppm) within 70-75 days. Residues from the 0.5 lb acephate/acre application were undetectable (<0.02 ppm) 20 days after spraying.

Peak residues in litter for gypsy moth control in Pennsylvania from aerial application of 0.5 lb acephate/acre was 5.5 ppm one day after spraying. Residues decreased to 0.03 ppm 20 days after spraying and were undetectable (<0.02 ppm) after 70 days (Devine 1975).

Devine (1975) reported that soil residues of aerially applied acephate in Pennsylvania were near or below detectable limits after spraying. An exposed soil sample in Pennsylvania contained 0.10 ppm acephate with no detectable residues at day 3. Tucker (1972) reported that acephate persisted longer in soil with increasing organic content.

Acephate breaks down rapidly in soil, but relatively slowly in water. The half-life in water at pH 7 and 70° F is about 50 days under laboratory conditions. In actual use, aquatic vegetation and microorganisms in sediment accelerate the degradation rate (Chevron 1975).

Acephate has a systemic effect in plants, and little of the residue can be washed off (Chevron 1975).

Bacillus thuringiensis (Bt) (Thuricide and Dipel)

Wollam and Yendol (1974) found that the residual activity of Bt at 10 days after treatment to be 50 percent of its original level.

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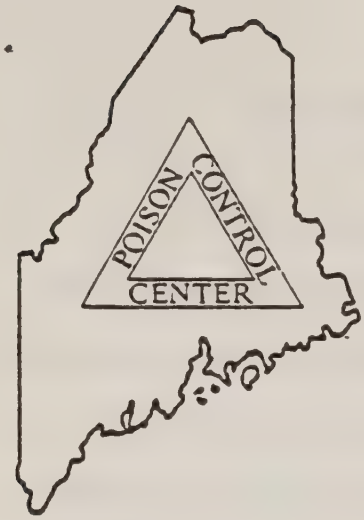
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APPENDIX B

LETTERS OF JANUARY 21, 1980 AND APRIL 25, 1980 FROM THE MAINE POISON CONTROL CENTER DIRECTOR, DR. FRANK LAWRENCE, TO KENNETH STRATTON, DIRECTOR MAINE BUREAU OF FORESTRY, OUTLINING THE HEALTH ADVISORY PANEL'S FINDINGS AND RECOMMENDATIONS CONCERNING THE VIRAL POTENTIATION OF SEVIN 4 OIL.



MAINE POISON CONTROL CENTER
22 BRAMHALL STREET, PORTLAND, MAINE 04102
TOLL FREE TELEPHONE: 1-800-442-6305

January 21, 1980

Mr. Kenneth Stratton, Director
Bureau of Forestry
Department of Conservation
Augusta, Maine 04330

Dear Mr. Stratton:

On January 18, 1980, the Health Advisory Panel that you appointed (list of members attached) met to review data available on Sevin-4-Oil, specifically that related to viral potentiation.

The findings of the Committee and recommendations are as follows:

A. Finding

There is a potential but inconclusive health risk of Sevin-4-Oil, on the basis of viral potentiation data available.

B. Recommendation

1. No uninformed, unconsented human exposure occurs during a forest spray operation.
2. The formulation must be fully disclosed to the satisfaction of the registering agency.
3. The spray formulation must be consistent with the formula registered.

C. Finding and Recommendation

Additional data is required:

a. laboratory data

b. epidemiologic data

The Panel members reviewed these findings and recommendations in writing and voted on them favorable and unanimously on January 18, 1980.

Sincerely yours,

Frank H. Lawrence

Frank H. Lawrence, M.D.
Health Advisory Panel Chairman

FHL/emc
enclosures
cc: Panel members

INTERPRETATION OF FINDINGS AND RECOMMENDATIONS

In research yet to be completed, early results suggest that Sevin-4-Oil, or one or more of its constitutents, potentiates the virus Herpes virus varicellae, the causative virus in chicken pox and "shingles". Enchancement ranges from 1.7 to four-fold.

Based on research which is highly conclusive and has been published, constituents of certain pesticide formulations have been shown to potentiate numerous other viruses in tissue culture. Additional research involving the use of laboratory mice has substantiated a significant amount of the tissue culture work.

Reye's Syndrome, a disease of children with a mortality rate that ranges up to 50%-60%, has, as one plausible etiology, a chemical-viral interaction. Incidental and very incomplete epidemiologic data has suggested that Reye's Syndrome may have some relationship to pesticide application. It is to be stressed that such findings form only an early hypothesis, not a conclusion.

Based on the above information the Panel offered the advice that there is an unknown degree of health risk. The Panel could not be conclusive because neither the laboratory data, nor the epidemiologic studies have done to firmly link an increase in human disease incidence with pesticide application. There is a very strong basis for worry, however, and the panel exercised its best judgment and suggested that wisdom leads one to conservatism where matters of human health are concerned.

Recognizing the potential for human exposure to Sevin-4-Oil in Forest Spray Operations; the Panel felt more stringent limitations should be developed by the Bureau of Forestry to prevent human exposure. Because of individual health states as well as the fact that an individual should have

the right to choose whether or not he or she should incur any health risk, the Panel suggested that there be no uninformed or unconsented exposure of human beings to Sevin-4-Oil during a spray operation.

Because of the difficulties of making intelligent decisions without full knowledge of facts the Panel felt that it is imperative that the Bureau of Forestry know all of the ingredients that they are spraying or are allowing to be sprayed. It is highly probable that not all of the ingredients listed as "inert" are actually inert. Therefore, it is mandatory, and in line with common sense health practices, that one know the ingredients of a spray formulation as well as the demonstrated and tested effects of that formulation before exposure of the populace.

Furthermore, the Panel recommends that if and when a formulation is approved for use that that and only that formulation be acceptable for use. Any other formulation should require another approval process. This recommendation implies a higher degree of quality control and surveillance of material sprayed.

Finally the Panel recognizes that it is offering a best judgment. As scientists, we recognize the need for firm data if firm conclusions are to be drawn. In this context we advise that the Bureau of Forestry recognize and support the need for further data both from the laboratory and from epidemiologic study.

HEALTH ADVISORY PANEL MEMBERS

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MAINE MEDICAL CENTER • PORTLAND, MAINE 04102

FRANK H. LAWRENCE, M.D., CHIEF
DEPARTMENT OF EMERGENCY MEDICINE
(207) 871-2617

April 25, 1980

Mr. Kenneth Stratton
Bureau of Forestry
Department of Conservation
Ray Building
Augusta, Maine 04330

Dear Mr. Stratton:

This letter is in response to your request for interpretation of the new data produced by Dr. Jerkofsky's laboratory and its relevance to and implications for Maine's Spruce Budworm Spray program.

I have talked with Dr. Jerkofsky and understand that she has viral potentiation data in hand which is reproduceable and statistically significant. The data indicate that carbaryl, the "active ingredient" of Sevin-4-oil, does increase the incidence of viral infection of tissue cultured cells; the range of enhancement varies from twofold to thirtyfold with a mean enhancement value of tenfold.

In light of this new data I have called several members of the Advisory Committee which met last January and have solicited their opinion relative to the additional data from Dr. Jerkofsky.

The discussions with these Health Advisory Committee members yield the following statements:

1) The additional data supplied by Dr. Jerkofsky lend further credence and support to the recommendations of January 21, 1980. Our level of concern about potential health risk is elevated, the rationale being as follows: As the validity of the data base increases, the degree of risk for tissue cultured cells increases. Our previous health statement which cites a "potential but inconclusive" health risk of Sevin-4-oil is based on the risk for tissue cultured cells and the implied risk to the total organism.

2) The original recommendations need not be modified to preclude spraying on the basis of possible individual patient exposure because the recommendations, as written, eliminate uninformed, unconsented human exposure.

3) From a public health point of view it would seem responsible and wise to attempt to minimize human exposure for those who have not supplied their consent. As I understand the proposed process, all who enter a spray block will be consenting. Thus those who can potentially be exposed but unconsenting would be in off-target dissemination areas. Thus droplet size, maximizing buffer zones and adherence to optimal spray conditions become of great importance.

I hope that these points address your concerns. Please let me know if you require additional explanation.

Sincerely yours,

Frank

Frank H. Lawrence, M.D.

FHL/emc
cc: Rufus Brown
Ellen Baum

APPENDIX C

LETTER FROM DOUGLAS D. CAMPT, EPA, TO WILLIAM H. CRANSTOUN, N.J. DEPARTMENT OF AGRICULTURE, CONCERNING CARBARYL RISK TO HUMAN HEALTH, MAY 1979.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D C 20460

MAY 16 1979

Mr. William M. Cranston
Department of Agriculture
P.O. Box 1888
Trenton, NJ 08625

Dear Bill:

This is a follow-up to our telephone conversation late last week concerning the New Jersey spray program for control of gypsy moth.

We are very concerned that any statement made by any of our employees could be construed as a recommendation to evacuate pregnant women from areas to be sprayed with carbaryl for gypsy moth control. The facts at our disposal do not in any way support such drastic action and we would consider it to be inappropriate to so alarm the public.

The Agency has reviewed all available information on the teratogenic potential of carbaryl and has no evidence suggesting that exposure to carbaryl may have caused birth defects in humans. Since experimental exposure to carbaryl has caused birth defects in dogs, carbaryl may have some potential to do so in humans, and the Agency is currently attempting to assess that potential. However, since a teratogenic study of carbaryl in rhesus monkeys was negative, it would appear that the teratogenic potential in humans, if any, is not great.

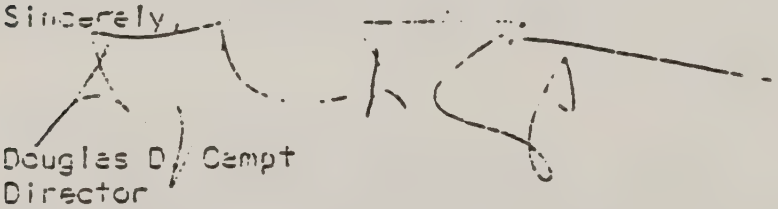
We have also reviewed and commented on the Environmental Impact Statement (EIS) submitted in connection with this program and we have also reviewed and commented on the "Final Environmental Statement for Cooperative Gypsy Moth Suppression and Regulatory Program, 1979 Activities," submitted in connection with this program by the U.S. Department of Agriculture (Forest Service and Animal and Plant Health Inspection Service). In these comments we commended the New Jersey Departments of Agriculture and Forestry for their extensive program of public involvement. The only concern which we expressed was that the maps distributed to spray area residents by the USDA showed lakes within the spray area

boundaries, and no reference was made on these maps to the 50 foot wide buffer zone which was planned in your portion of the final environmental statement (page II).

One can never conclude that risks from exposure to any chemical are zero, and it is only reasonable and prudent to suggest that women who may be pregnant should avoid any unnecessary exposure to carbaryl and other chemicals. This is easily accomplished in the use of carbaryl for gypsy moth control by remaining indoors or under suitable cover at the time the application is made. Once the spray settles, any further potential for exposure is greatly reduced, and should be of no concern.

I have queried personnel in OPP who are responsible for the management of this chemical and it is my understanding that the above is the essence of the information that has been given to reporters, environmentalists, state officials and the public. I am sorry if the information has been misinterpreted and any inconvenience this might have caused.

Sincerely,



Douglas D. Campt
Director
Registration Division TS-767

APPENDIX D

PHYSICAL EFFECTS FROM CHEMICAL AND BIOLOGICAL METHODS

Physical effects of insecticide treatment include: (1) potential contamination of organic farm crops, (2) aircraft noise, (3) air traffic conflicts, (4) energy consumption, (5) residue deposit and breakdown, and (6) loss of insecticide through drift or other reasons.

(1) Organic Farms

In 1980 there were twenty-four organic farms certified in Maine. Of these, two were located within the Spruce-Fir Protection District (Figure 9). The Maine Bureau of Forestry takes special precautions to avoid insecticide contamination of these as well as other known organic farms, upon request. Although special precautions would be taken to insure that known organic farms receive no insecticide, there remains a possibility that some insecticide contamination could occur.

(2) Aircraft Noise

Noise created by spray aircraft is a potential problem around municipal airports used in the insecticide project. However, in most cases this is not expected to cause a great deal of concern due to the short duration of a spray project.

(3) Air Traffic Conflicts

There have been a few near misses between spray aircraft and U.S. Air Force aircraft flying at low altitudes along target runs in Maine. This may continue to occur even though Air Force authorities are notified of the spray operation.

(4) Energy Consumption

Another aspect of spray operations is the amount of energy or fuel needed. The Maine Bureau of Forestry estimated that in 1980 100,000 gallons or aircraft fuel were needed for spray and monitor aircraft and that as much as 75,000 gallons of No. 1 fuel oil were used to mix with insecticides.

(5) Residues

When insecticides are released into the environment, they are deposited on plant foliage, litter soil, water, or non-target organisms where they remain for varying periods depending on their breakdown rates. The insecticides used are non-persistent and break down rather rapidly. Each chemical insecticide considered for use has breakdown products which have insecticidal activity. The breakdown of Sevin 4 Oil results in the production of 1-napthol; trichlorfon in the production of DDVP; and acephate in the production of O,S-dimethyl phosphoramidothioate (trade name Monitor). As stated previously the effects of these breakdown products with insecticidal activity are

included in the evaluation of the effects of the parent compounds. Studies indicate that the highest residues are deposited on plant foliage.

In water the insecticides are diluted to varying extents depending on water depth and flow. A review of some of the useful references relating to residues is found in Appendix A.

In addition to the active ingredient, insecticide formulations contain inert ingredients that are added to improve handling properties. These materials are dispersed into the environment along with the active ingredient.

(6) Loss of Insecticide Through Drift and Other Reasons

Some insecticide may be lost through drift outside target areas, evaporation of inactive ingredients in the formulation, accidental spills from aircraft, equipment failure and human error.

After release from the spray aircraft, insecticides are carried by air currents. Short-range drift through the air is not only desirable but necessary to carry the insecticide to the target insect for maximum effectiveness. Drift outside target areas is undesirable but occurs to some extent during any insecticide application. Distance and amount of drift is dependent upon a large number of factors and can be partially controlled through careful application. Drift occurs with any insecticide, so care is required regardless of which one is used. Drift is reduced with lower release height. Consequently, the use of smaller aircraft which fly at lower altitudes can reduce drift near sensitive areas.

Because some drift outside target areas can be expected, buffer zones would be used around sensitive areas such as permanent human habitation to minimize the amount of insecticide reaching these areas. Buffers are areas over which spray aircraft would not be allowed to release insecticide. The purpose of the buffer is to "absorb" most of the off-target drift so that it does not reach sensitive areas.

Buffers are an accepted means of reducing contamination of sensitive areas (EPA 1977). Preliminary results from a 1979 Maine study which examined water contamination, show that with buffers, streams were contaminated less than in previous years when buffers were used only on larger streams (personal communication, Joan Garner Trial). In the same study, results show that buffers do not completely eliminate water contamination. An extensive water and airborne pesticide drift sampling study was conducted in Maine in 1979 (SCS Engineers 1980). The results of this study also indicated that some stream contamination is unavoidable. Even with buffers, runoff generated from rainfall would carry some insecticide from watersheds into streams. Sevin 4 Oil® and Orthene Forest Spray® were much more resistant to runoff than Dylox®. Some small streams and ponds could not be avoided and would receive direct application of insecticide. However, the quantity of insecticide reaching these areas is usually considerably reduced by the filtering action of trees and other plants.

During a study of carbaryl application in the Maine spruce budworm project in 1979 the South Carolina Epidemiologic Studies Center, under contract to the EPA, detected a small amount of carbaryl in air samples 12 miles from a spray block. The amount detected was far below one percent of the permissable time weighted average for occupational exposure to carbaryl. The block had been partially treated in early evening and completed the following morning. Winds over the 24 hour period ranged from 0 to 15 mph. (South Carolina Epidemiologic Studies Center 1979). In 1980 the EPA Office of Enforcement and the Maine Department of Human Services conducted separate air sampling at several sites during the Cooperative Spruce Budworm Suppression Project in Maine. EPA results indicated no measurable drift of carbaryl into eight communities bordering the treated forest. The EPA study further indicated drift of carbaryl at least 1 mile beyond spray boundaries in one case and Bt drift 1 to 4 miles downwind from a spray block (EPA 1980). The Maine Department of Human Service's study monitored for carbaryl in four of the same communities as in the EPA study, but used a more sensitive monitoring technique. Traces of carbaryl, or its breakdown product, 1-naphthol, were detected in the four communities, some of which were 50 to 100 miles from the nearest spruce budworm spray block (Maine Department of Human Services 1981). Further details on this study are found in Appendix A.

Some formulated insecticide may be lost through evaporation after release and before it reaches the target area. The amount of evaporation depends on the vapor pressure of the insecticide formulation. Evaporation affects the inert ingredients in the formulation much more than the active ingredient. Insecticides used to suppress spruce budworm have very low vapor pressures and significant losses of the active ingredient due to evaporation is not expected.

Spray cards have been used in the past to account for aerially applied insecticide, but have been shown to be an imperfect tool for this use. Spray cards are exposed under the tree canopy or in forest openings. The insecticide may be filtered out by trees before reaching the cards or parts of the insecticide formulation may be lost through evaporation. Recent observations in Maine and Canada show that less than 50 percent of calibrated spray volume is recovered on spray cards (Armstrong 1977; Armstrong and Nigam 1975, personal communication, J. Barry, USDA Forest Service).

Occasionally insecticides may be released in excessive amounts. Aircraft are equipped with emergency dump valves which can be used to quickly release a load of insecticide if necessary to bring the aircraft down safely. A dumped insecticide load is deposited over a small area and the amount of active ingredient per unit area can be quite high. Such incidents have occurred in previous years in Maine (Appendix D Table 1).

Insecticides may be unintentionally released over non-target areas when spray systems malfunction. When spray systems are not properly maintained, nozzles may continually leak some insecticides when shut off.

More refined mapping of spray blocks is needed to permit deletion of non-type and recently harvested stands so that only the minimum amount of insecticide necessary to protect the resource is used. This would in turn, reduce drift. Spray block mapping procedures would continue to be refined.

Appendix D Table 1 - Insecticide spills reported during Maine Spruce Budworm Spray Suppression Projects, 1974-1980.

Year	Type aircraft an location	Type and amount released insecticide	Environmental effect if known
1974	None	None	None
1975	TBM-crashed on take off	About 800 gal Sumithion	None recorded
1976	None	None	None
1977	TBM-lost load on take off	About 600 gal Sevin 4 Oil	Unknown
1977	TBM-lost load 10 mi. from Millinocket Airport	About 600 gal Sevin 4 Oil	Unknown
1978	None	None	None
1979	Thrush Commander Hobbstown, ME	About 250 gal Orthene	None observed
1979	C-54 crashed in Eagle Lake	Sevin 4 Oil less than 50 gal reached water. Greater but undetermined amount released over land areas.	Heavy Sevin residue on vegetation in and adjacent to lake. Small number of dead fish (smelt) observed but cause not certain, possibly normal.
1980	None	None	None

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APPENDIX E

BENEFIT-COST ANALYSIS FOR ALTERNATIVE PROGRAMS

About 5 million acres of Maine's 8 million acre spruce-fir forest are threatened by the spruce budworm. Under alternative 1, all 5 million acres threatened by the spruce budworm would be protected by using insecticides over the 5 year program. This action would be similar to that taken during the past 5 years when about 5 million acres were also protected. Under alternatives 2 and 3, a maximum of about 3 million acres would be protected by using insecticides. The other 2 million acres of the threatened resource that would not be protected with insecticides includes environmentally sensitive areas in which insecticides would not be applied and areas withdrawn from insecticide protection on request of landowners. Salvage and other harvesting could be carried out on most of this acreage. Under alternative 4, 1 million acres of the threatened resource would be protected while salvage and other harvesting were carried out on unprotected acres. Maine's spruce-fir resource including the area to be protected under the alternatives considered must in the long term supply spruce-fir for 12 pulpmills and 150 sawmills in Maine, and several sawmills in Canada. The fifth alternative is no action, except salvage and other harvesting.

Without protection from spruce budworm, spruce-fir mortality over the threatened acres may accumulate to an average of about 7.6 cords per acre, or almost half of the average spruce-fir inventory volume of 17 cords per acre (Appendix E Table 1). For several years, supply to mills would not be affected. Trees dead 2 to 5 years, depending on mill requirements, could be used. Probably as much as 3.4 cords of killed trees per acre could be used, (20 percent of total volume of 17 cords per acre and about one-half of the expected average cumulative mortality of 7.6 cords per acre). However, trees dead longer than 5 years and dead volume in excess of 3.4 cords per acre probably could not be harvested and would be lost.

Without continued insecticide protection (no action alternative), it is assumed that landowners would clearcut threatened stands that would have been protected since industrial landowners would be inclined to harvest their own timber first. The spruce-fir harvest in Maine is currently about 2.8 million cords each year. This amount of wood could be supplied by clearcutting about 165,000 acres each year (165,000 x 17 cords per acre = 2.8 million cords). As spruce-fir mortality accumulated and the average volume per acre dropped below 17 cords, mill supply requirements might be met by increasing the acreage cutover. However, because of increased harvest cost and time required to build access roads, the acreage cutover probably could not be increased indefinitely. In this analysis it is assumed that without protection a maximum of 200,000 acres could be clearcut annually and that harvest would continue until the area that would have been protected was cutover once. Without protection, the spruce-fir inventory on which mills are dependent would be harvested before young stands were old enough to supply mills.

Protection with insecticides (alternative 1, 2, 3, or 4) offers an opportunity to first harvest dead and threatened timber on the acreage not protected while forestalling tree mortality on the protected acreage. In this analysis it is assumed that with protection, landowners would first seek to supply mills by harvesting timber on the acreage not protected, thereby extending the overall spruce-fir inventory. After several years some dead trees on the acreage not protected would have deteriorated making them unuseable. The volume of dead trees would also exceed that which could be accepted for utilization by mills. Harvest would then begin on the area protected with insecticides. Harvest cuts in the protected area would include both clearcuts and partial cuts. According to Field (1980) landowners' objectives are to manage about one-half of the spruce-fir resource under an even-aged system and one-half under an uneven-aged system. With protection, presumably this pattern of management would continue. It is assumed that mills could be supplied with 2.8 million cords each year by clearcuts and shelterwood cuts (even-aged system) on about 80,000 acres, and partial cuts (uneven-aged system) on 240,000 acres (assumes one-third of spruce-fir volume is removed during a partial cut). Of the total acreage cutover annually (320,000 acres), it is assumed that 160,000 acres, or 50 percent, would no longer require insecticide protection. The size of the area no longer requiring protection would depend on the size of area clearcut, the extent to which balsam fir (the species most likely to be killed by spruce budworm) is removed during partial cuts and the extent to which cutover areas could be excluded from spray blocks.

With or without protection the current spruce-fir inventory might be harvested before young stands were old enough to supply mills. With protection, however, the present spruce-fir inventory may supply mills longer and expected future disruptions in supply may be of shorter duration and less severe.

Appendix E Table 1 - Cumulative volume of spruce-fir mortality without protection, portion of this volume that could be salvaged without protection, portion of this volume that could not be salvaged without protection, and spruce-fir volume available for harvest without protection.

Year	Cumulative mortality (cords/acre) 1/	Mortality salvagable (cords/acre) 2/	Cumulative mortality not salvagable (cords/acre)	Volume available for harvest without protection (cords/acre) 3/
1981	0.04	0.04	0.00	17.00
1982	0.17	0.13	0.00	17.00
1983	0.34	0.17	0.00	17.00
1984	0.55	0.51	0.04	16.96
1985	0.85	0.68	0.17	16.83
1986	1.03	0.69	0.34	16.66
1987	2.55	2.00	0.55	16.45
1988	4.25	3.40	0.85	16.15
1989	6.80	3.40	3.40	13.60
1990	7.65	3.40	4.25	12.75
1991	7.65	3.40	4.25	12.75
1992	7.65	0.85	6.80	10.20
Beyond 1992	7.65	0.00	7.65	9.35

1/ This scenario of cumulative mortality is similar to that used in recent supply projections by Green Woods Project (1980). The projections by Green Woods Project were for about 7 million acres of spruce-fir type in Maine and may have been somewhat different if applied to a smaller area selected for protection, since average volume per acre of spruce-fir might be higher in such an area. Trees in Maine have been defoliated for several years by the spruce budworm. With this situation, the scenario as used above assumes mortality would begin immediately if the resource were not protected.

2/ Current year's mortality volume plus previous two year's mortality up to a maximum of 20 percent of per acre volume (3.40 cords/acre).

3/ Seventeen cords/acre is the average volume of spruce-fir growing stock per acre in Maine on commercial forest land classified as spruce-fir type (Ferguson and Kingsley 1972).

Four protection program alternatives are considered, in addition to the alternative of no action or no protection. The alternatives considered are as follows:

(1) From 1981 to 1985, protect 5 million acres by applying chemical insecticides each year to an average of about 1.8 million acres (36 percent of the protected area) and the biological Bt each year to an average of about 100,000 acres (2 percent of the protected area). From 1981 to 1983 harvest all spruce-fir needed to supply mills from areas not imminently threatened by the spruce budworm. After 1983, harvest all spruce-fir needed to supply mills from the protected area, remove 160,000 acres cutover each year from protection, and each year apply chemicals to 36 percent and Bt to 2 percent of the threatened acreage remaining under protection. Continue protection until the original 5 million acre protection area is cutover once.

(2) From 1981 to 1985, protect 3 million acres by applying chemical insecticides each year to an average of about 1.3 million acres (43.3 percent of the protected area) and the biological Bt each year to an average of about 100,000 acres (3.3 percent of the protected area). From 1981 to 1985, harvest all spruce-fir needed to supply mills from the 2 million acres not protected with insecticides. From 1986 to 1990, harvest one-half of the spruce-fir needed to supply mills from the 2 million acres not protected and one-half from the protected area. Remove 80,000 acres cutover from protection each year during this period (1986 to 1990), and each year apply chemicals to 43.3 percent and Bt to 3.3 percent of the acreage remaining under protection. After 1990, harvest all spruce-fir needed to supply mills from the protected area, remove 160,000 acres cutover each year from protection, and each year apply chemicals to 43.3 percent and Bt to 3.3 percent of the acreage remaining under protection. Continue protection until the original 3 million acre protected area is cutover once.

(3) From 1981 to 1985, protect 3 million acres by applying chemical insecticides each year to an average of about 950,000 acres each year (31.6 percent of the protected area) and the biological Bt each year to an average of about 150,000 acres each year (5 percent of the protected area). From 1981 to 1985, harvest all spruce-fir needed to supply mills from the 2 million threatened acres not protected with insecticides. From 1986 to 1990, harvest one-half of the spruce-fir needed to supply mills from the 2 million acres not protected and one-half from the protected area. Remove 80,000 acres cutover from protection each year during this period (1986 to 1990), and each year apply chemicals to 31.6 percent and Bt to 5 percent of the acreage remaining under protection. After 1990, harvest all spruce-fir needed to supply mills from the protected area, remove 160,000 of the acres cutover each year from protection, and each year apply chemicals to 31.6 percent and Bt to 5 percent of the acreage remaining under protection. Continue protection until the original 3 million acre protected area is cutover once.

(4) From 1981 to 1985, protect 1 million acres by applying the biological Bt each year to an average of about 500,000 acres (50 percent of the protected area). From 1981 to 1985, harvest all spruce-fir needed to supply mills from the 4 million acres not protected with insecticides. Beginning in 1986, harvest 700,000 cords each year from the protected area. Remove 40,000 cutover acres from protection each year, and each year apply Bt to 50 percent of the acreage remaining under protection. Continue protection until the original 1 million acre protected area is cutover once.

Chemical insecticides have in the past provided adequate protection if applied to an average of one-third to one-half of the resource annually. Mortality losses in areas protected with chemicals have generally been negligible. Limited experience with Bt indicates that it is somewhat less effective than chemicals and might have to be applied to the same acres annually or no less than once every two years to provide protection against tree mortality.

Alternative 1 is expected to protect spruce-fir on 5 million acres and alternatives 2 and 3 are expected to protect spruce-fir on 3 million acres (Appendix E Tables 2 and 3). Spruce-fir mortality on protected areas is assumed to be zero under alternatives 1, 2, and 3. This is a generous assumption since some protected fir may die of causes unrelated to budworm before it can be harvested and the level of protection provided by insecticides may be somewhat less than perfect.

In addition, risk of spruce-fir mortality in protected areas is assumed to be the same for alternatives 1, 2, and 3. The soundness of this assumption is uncertain. Risk of tree mortality may vary under the alternatives. However, due to lack of data on any differences, these assumptions were necessary. Alternatives 2 and 3 should provide a similar level of protection, even though more acres would be treated with insecticides each year under alternative 2 than under alternative 3. Increased precision in spray block design and insecticide application under alternative 3 would allow insecticide application on fewer acres each year than under alternative 2, while allowing an equivalent level of protection.

Alternative 4 is expected to protect spruce-fir on the 1 million acres (Appendix E Table 4). Risk of tree mortality might be somewhat higher with alternative 4 than with the other alternatives because of the necessary reliance on Bt for protection in areas with high budworm populations. Unchecked tree mortality would occur on 4 million acres not protected under alternative 4, as compared to 2 million acres under the first three alternatives.

Costs of the alternatives would vary. Sevin 4 Oil was applied in 1980 at a cost of about $4.65 per acre, Bt was applied at a cost of about $12.50 per acre (Appendix E Table 5). Costs of the alternatives would vary with the mix of chemicals and biologicals used and acreage treated (Appendix E Tables 6, 7, 8 and 9).

Appendix E Table 2 - Benefits of insecticide protection under alternative program 1.

Year	Volume harvested with protection (MM cords)	Volume harvested without protection (MM cords)	Net volume harvested attributable to protection (MM cords)	Value of annual benefit @ $14.00/cord 1/ (MM$)	Present value of annual benefit (MM$) 2/ 4%	10%
1981	0.0	2.8	0.0	0.0	0.00	0.00
1982	0.0	2.8	0.0	0.0	0.00	0.00
1983	0.0	2.8	0.0	0.0	0.00	0.00
1984	2.8	2.8	0.0	0.0	0.00	0.00
1985	2.8	2.8	0.0	0.0	0.00	0.00
1986	2.8	2.8	0.0	0.0	0.00	0.00
1987	2.8	2.8	0.0	0.0	0.00	0.00
1988	2.8	2.8	0.0	0.0	0.00	0.00
1989	2.8	2.7	0.1	1.4	1.38	0.65
1990	2.8	2.6	0.2	2.8	1.96	1.19
1991	2.8	2.6	0.2	2.8	1.89	1.08
1992	2.8	2.0	0.8	11.2	7.28	3.93
1993	2.8	1.9	0.9	12.6	7.87	4.01
1994	2.8	1.9	0.9	12.6	7.57	3.65
1995	2.8	1.9	0.9	12.6	7.28	3.32
1996	2.8	1.9	0.9	12.6	7.00	3.02
1997	2.8	1.9	0.9	12.6	6.73	2.74
1998	2.8	1.9	0.9	12.6	6.47	2.49
1999	2.8	1.9	0.9	12.6	6.22	2.27
2000	2.8	1.9	0.9	12.6	5.98	2.06
2001	2.8	1.9	0.9	12.6	5.75	1.87
2002	2.8	1.9	0.9	12.6	5.53	1.70
2003	2.8	1.9	0.9	12.6	5.32	1.55
2004	2.8	1.9	0.9	12.6	5.11	1.41
2005	2.8	1.9	0.9	12.6	4.92	1.28
2006	2.8	1.9	0.9	12.6	4.73	1.16
2007	2.8	0.0	2.8	39.2	14.14	3.29
2008	2.8	0.0	2.8	39.2	13.60	2.99
2009	2.8	0.0	2.8	39.2	13.07	2.72
2010	2.8	0.0	2.8	39.2	12.57	2.47
2011	2.8	0.0	2.8	39.2	12.09	2 25
2012	2.8	0.0	2.8	39.2	11.62	2.04
2013	2.8	0.0	2.8	39.2	11.17	1.86
2014	2.8	0.0	2.8	39.2	10.33	1.69
TOTAL					197.58	58.69

1/ Stumpage value of spruce-fir currently is $14.00/cord. This is a weighted average for spruce-fir

Appendix E Table 3 - Benefits of insecticide protection under alternative programs 2 and 3.

Year	Volume harvested with protection (MM cords)	Volume harvested without protection (MM cords)	Net volume harvested attributable to protection (MM cords)	Value of annual benefit @ $14.00/cord 1/ (MM$)	Present value of annual benefit (MM$) 2/ 4%	10%
1981	0.0	2.8	0.0	0.0	0.00	0.00
1982	0.0	2.8	0.0	0.0	0.00	0.00
1983	0.0	2.8	0.0	0.0	0.00	0.00
1984	0.0	2.8	0.0	0.0	0.00	0.00
1985	0.0	2.8	0.0	0.0	0.00	0.00
1986	1.4	2.8	0.0	0.0	0.00	0.00
1987	1.4	2.8	0.0	0.0	0.00	0.00
1988	1.4	2.8	0.0	0.0	0.00	0.00
1989	1.4	2.7	0.0	0.0	0.00	0.00
1990	1.4	2.6	0.0	0.0	0.00	0.00
1991	2.8	2.6	0.2	2.8	1.89	1 08
1992	2.8	2.0	0.8	11.2	7.28	3.93
1993	2.8	1.9	0.9	12.6	7.87	4 01
1994	2.8	1.9	0.9	12.6	7.57	3.65
1995	2.8	1.9	0.9	12.6	7.28	3.32
1996	2.8	1.9	0.9	12.6	7.00	3.02
1997	2.8	0.0	2.8	39.2	20.93	8.53
1998	2.8	0.0	2.8	39.2	20.12	7.76
1999	2.8	0.0	2.8	39.2	19.35	7.05
2000	2.8	0.0	2.8	39.2	18.61	6.41
2001	2.8	0.0	2.8	39.2	17.89	5.83
2002	2.8	0.0	2.8	39.2	17.20	5.30
2003	2.8	0.0	2.8	39.2	16.54	4.82
2004	2.8	0.0	2.8	39.2	15.90	4.38
2005	2.8	0.0	2.8	39.2	15.29	3.98
2006	1.4	0.0	1.4	19.6	7.35	1.81
TOTAL					208.07	74.88

1/ Stumpage value of spruce-fir currently is $14.00/cord. This is a weighted average for spruce-fir sawtimber and pulpwood.
2/ Discount rate.

Appendix E Table 4 - Benefits of insecticide protection under alternative program 4.

Year	Volume harvested with protection (MM cords)	Volume harvested without protection (MM cords)	Net volume harvested attributable to protection (MM cords)	Value of annual benefit @ $14.00/cord 1/ (MM$)	Present value of annual benefit (MM$) 2/ 4%	10%
1981	0.0	1.0	0.0	0.0	0.00	0.00
1982	0.0	1.0	0.0	0.0	0.00	0.00
1983	0.0	1.0	0.0	0.0	0.00	0.00
1984	0.0	1.0	0.0	0.0	0.00	0.00
1985	0.0	1.0	0.0	0.0	0.00	0.00
1986	0.7	1.0	0.0	0.0	0.00	0.00
1987	0.7	1.0	0.0	0.0	0.00	0.00
1988	0.7	1.0	0.0	0.0	0.00	0.00
1989	0.7	1.0	0.0	0.0	0.00	0.00
1990	0.7	1.0	0.0	0.0	0.00	0.00
1991	0.7	1.0	0.0	0.0	0.00	0.00
1992	0.7	0.8	0.0	0.0	0.00	0.00
1993	0.7	0.7	0.0	0.0	0.00	0.00
1994	0.7	0.7	0.0	0.0	0.00	0.00
1995	0.7	0.7	0.0	0.0	0.00	0.00
1996	0.7	0.0	0.7	9.8	5.44	2.34
1997	0.7	0.0	0.7	9.8	5.23	2.13
1998	0.7	0.0	0.7	9.8	5.03	1.94
1999	0.7	0.0	0.7	9.8	4.84	1.76
2000	0.7	0.0	0.7	9.8	4.65	1.60
2001	0.7	0.0	0.7	9.8	4.47	1.46
2002	0.7	0.0	0.7	9.8	4.30	1.32
2003	0.7	0.0	0.7	9.8	4.13	1.20
2004	0.7	0.0	0.7	9.8	3.98	1.09
2005	0.7	0.0	0.7	9.8	3.82	0.99
2006	0.7	0.0	0.7	9.8	3.68	0.90
2007	0.7	0.0	0.7	9.8	3.53	0.82
2008	0.7	0.0	0.7	9.8	3.40	0.75
2009	0.7	0.0	0.7	9.8	3.27	0.68
TOTAL					59.77	18.98

1/ Stumpage value of spruce-fir currently is $14.00/cord. This is a weighted average for spruce-fir sawtimber and pulpwood.
2/ Discount rate.

Appendix E Table 5 - Breakdown of insecticide application costs, 1980.

	Sevin 4 Oil ($/acre)	Bt ($/acre)
Spray Aircraft and Other Aircraft	1.90	5.68 1/
Insecticide Cost and Mixing and Loading	2.07	5.45
Environmental Monitoring	0.19	0.00
Temporary Labor	0.21	0.73
Other 2/	0.28	0.64
TOTAL	4.65	12.50

1/ This cost estimate is based on use of large helicopters. Costs of application might be somewhat less with fixed-winged aircraft.

2/ Includes cost of security measures.

Appendix E Table 6 - Cost of insecticide protection under alternative program 1.

Year	Size of area under protection (MM acres)	Acres treated (MM acres)		Treatment cost (MM$) 1/	Present value of cost (MM$) 2/	
		Chemicals	Bt		4%	10%
1981	5.00	1.80	0.10	9.62	9.62	9.62
1982	5.00	1.80	0.10	9.62	9.25	8.75
1983	5.00	1.80	0.10	9.62	8.89	7.95
1984	4.84	1.74	0.10	9.34	8.30	7.02
1985	4.68	1.68	0.09	8.94	7.64	6.11
1986	4.52	1.62	0.09	8.66	7.12	5.38
1987	4.36	1.57	0.09	8.43	6.66	4.76
1988	4.20	1.51	0.08	8.02	6.09	4.12
1989	4.04	1.45	0.08	7.74	5.66	3.61
1990	3.88	1.39	0.08	7.46	5.24	3.16
1991	3.72	1.33	0.07	7.06	4.77	2.72
1992	3.56	1.28	0.07	6.83	4.44	2.39
1993	3.40	1.22	0.07	6.55	4.09	2.09
1994	3.24	1.16	0.06	6.14	3.69	1.78
1995	3.08	1.10	0.06	5.87	3.39	1.55
1996	2.42	1.05	0.06	5.63	3.13	1.35
1997	2.76	0.99	0.06	5.35	2.86	1.16
1998	2.60	0.94	0.05	5.00	2.57	0.99
1999	2.44	0.88	0.05	4.71	2.32	0.85
2000	2.28	0.82	0.05	4.44	2.11	0.73
2001	2.12	0.76	0.04	4.03	1.84	0.60
2002	1.96	0.71	0.04	3.80	1.67	0.51
2003	1.80	0.65	0.04	3.52	1.49	0.43
2004	1.64	0.59	0.03	3.12	1.27	0.35
2005	1.48	0.53	0.03	2.84	1.11	0.29
2006	1.32	0.48	0.03	2.61	0.98	0.24
2007	1.16	0.42	0.02	2.20	0.79	0.18
2008	1.00	0.36	0.02	1.92	0.67	0.15
2009	0.84	0.30	0.02	1.65	0.55	0.11
2010	0.68	0.24	0.01	1.24	0.40	0.08
2011	0.52	0.19	0.01	1.01	0.31	0.06
2012	0.36	0.13	0.01	0.73	0.22	0.04
2013	0.20	0.07	0.00	0.33	0.09	0.02
2014	0.04	0.01	0.00	0.05	0.01	0.00
TOTAL					119.24	79.15

1/ Treatment cost at $4.65/acre for chemicals and $12.50/acre for Bt.

2/ Discount rate

Appendix E Table 7 - Cost of insecticide protection under alternative program 2.

Year	Size of area under protection (MM acres)	Acres treated (MM acres)		Treatment cost (MM$) 1/	Present value of cost (MM$) 2/	
		Chemicals	Bt		4%	10%
1981	3.00	1.30	0.10	7.30	7.30	7.30
1982	3.00	1.30	0.10	7.30	7.02	6.64
1983	3.00	1.30	0.10	7.30	6.75	6.03
1984	3.00	1.30	0.10	7.30	6.49	5.48
1985	3.00	1.30	0.10	7.30	6.24	4.99
1986	2.92	1.26	0.10	7.11	5.84	4.41
1987	2.84	1.23	0.09	6.84	5.41	3.86
1988	2.76	1.20	0.09	6.71	5.10	3.44
1989	2.68	1.16	0.09	6.52	4.76	3.04
1990	2.60	1.13	0.09	6.38	4.48	2.71
1991	2.44	1.06	0.08	5.93	4.01	2.29
1992	2.28	0.99	0.08	5.60	3.64	1.96
1993	2.12	0.92	0.07	5.15	3.22	1.64
1994	1.96	0.85	0.06	4.70	2.82	1.36
1995	1.80	0.78	0.06	4.38	2.53	1.15
1996	1.64	0.71	0.05	3.93	2.18	0.94
1997	1.48	0.64	0.05	3.60	1.92	0.78
1998	1.32	0.57	0.04	3.15	1.62	0.62
1999	1.16	0.50	0.04	2.83	1.40	0.51
2000	1.00	0.43	0.03	2.37	1.12	0.39
2001	0.84	0.36	0.03	2.05	0.94	0.30
2002	0.68	0.29	0.02	1.60	0.70	0.22
2003	0.52	0.23	0.02	1.31	0.55	0.16
2004	0.32	0.14	0.01	0.78	0.32	0.09
2005	0.20	0.09	0.01	0.54	0.21	0.05
2006	0.04	0.02	0.00	0.09	0.03	0.01
TOTAL					86.60	60.37

1/ Treatment cost at $4.65/acre for chemicals and $12.50/acre for Bt.

2/ Discount rate

Appendix E Table 8 - Cost of insecticide protection under alternative program 3.

Year	Size of protection zone (MM acres)	Acres treated (MM acres)		Treatment cost 1/ (MM$)	Present value of cost (MM$) 2/	
		Chemicals	Bt		4%	10%
1981	3.00	0.95	0.15	6.29	6.29	6.29
1982	3.00	0.95	0.15	6.29	6.05	5.72
1983	3.00	0.95	0.15	6.29	5.82	5.20
1984	3.00	0.95	0.15	6.29	5.59	4.73
1985	3.00	0.95	0.15	6.29	5.38	4.30
1986	2.92	0.92	0.15	6.15	5.05	3.82
1987	2.84	0.90	0.14	5.93	4.69	3.35
1988	2.76	0.88	0.14	5.84	4.44	3.00
1989	2.68	0.85	0.13	5.58	4.08	2.60
1990	2.60	0.82	0.13	5.44	3.82	2.31
1991	2.44	0.77	0.12	5.08	3.43	1.96
1992	2.28	0.72	0.11	4.72	3.07	1.65
1993	2.12	0.67	0.11	4.49	2.80	1.43
1994	1.96	0.62	0.10	4.13	2.48	1.20
1995	1.80	0.57	0.10	3.90	2.25	1.03
1996	1.64	0.52	0.08	3.42	1.90	0.82
1997	1.48	0.47	0.07	3.06	1.63	0.67
1998	1.32	0.42	0.07	2.83	1.45	0.56
1999	1.16	0.37	0.06	2.47	1.22	0.44
2000	1.00	0.32	0.05	2.11	1.00	0.35
2001	0.84	0.27	0.04	1.76	0.80	0.26
2002	0.68	0.21	0.03	1.35	0.59	0.18
2003	0.52	0.16	0.03	1.12	0.47	0.14
2004	0.32	0.10	0.02	0.72	0.29	0.08
2005	0.20	0.06	0.01	0.40	0.16	0.04
2006	0.04	0.01	0.00	0.05	0.02	0.00
TOTAL					74.77	52.13

1/ Treatment cost at $4.65/acre for chemicals and $12.50/acre for Bt.

2/ Discount rate

Appendix E Table 9 - Cost of insecticide protection under alternative program 4.

Year	Size of area under protection (MM acres)	Acres treated (MM acres)		Treatment cost (MM$) 1/	Present value of cost (MM$) 2/	
		Chemicals	Bt		4%	10%
1981	1.00	-	0.50	6.25	6.25	6.25
1982	1.00	-	0.50	6.25	6.01	5.68
1983	1.00	-	0.50	6.25	5.78	5.17
1984	1.00	-	0.50	6.25	5.56	4.70
1985	1.00	-	0.50	6.25	5.34	4.27
1986	0.96	-	0.48	6.00	4.93	3.73
1987	0.92	-	0.46	5.75	4.54	3.25
1988	0.88	-	0.44	5.50	4.18	2.82
1989	0.84	-	0.42	5.25	3.84	2.45
1990	0.80	-	0.40	5.00	3.51	2.12
1991	0.76	-	0.38	4.75	3.21	1.83
1992	0.72	-	0.36	4.50	2.92	1.58
1993	0.68	-	0.34	4.25	2.50	1.35
1994	0.64	-	0.32	4.00	2.40	1.16
1995	0.60	-	0.30	3.75	2.17	0.99
1996	0.56	-	0.28	3.50	1.94	0.84
1997	0.52	-	0.26	3.25	1.74	0.71
1998	0.48	-	0.24	3.00	1.54	0.59
1999	0.44	-	0.22	2.75	1.36	0.49
2000	0.40	-	0.20	2.50	1.19	0.41
2001	0.36	-	0.18	2.25	1.03	0.33
2002	0.32	-	0.16	2.00	0.88	0.27
2003	0.28	-	0.14	1.75	0.74	0.21
2004	0.24	-	0.12	1.50	0.61	0.17
2005	0.20	-	0.10	1.25	0.49	0.13
2006	0.16	-	0.08	1.00	0.38	0.09
2007	0.12	-	0.06	0.75	0.27	0.06
2008	0.08	-	0.04	0.50	0.17	0.04
2009	0.04	-	0.02	0.25	0.08	0.02
TOTAL					75.56	51.91

1/ Treatment cost at $4.65/acre for chemicals and $12.50/acre for Bt.

2/ Discount rate

Alternative 1 has a favorable benefit-cost ratio at the 4 percent discount rate and an unfavorable benefit-cost ratio at the 10 percent discount rate. Benefit-cost ratios at both discount rates are favorable for alternatives 2, and 3, and unfavorable for alternative 4 (Appendix E Table 10).

Appendix E Table 10 - Benefit-cost ratios for four alternative protection programs using insecticides.

Alternative programs	Present value of annual benefits (MM$)		Present value of annual costs (MM$)		Benefit-cost ratios	
	4% 1/	10%	4%	10%	4%	10%
1	197.58	58.69	119.24	79.15	1.66:1	0.74:1
2	208.07	74.88	86.60	60.37	2.40:1	1.24:1
3	208.07	74.88	74.77	52.13	2.78:1	1.44:1
4	59.77	18.98	75.56	51.91	0.79:1	0.37:1

1/ Discount rate

This analysis assumes that the spruce budworm outbreak will continue indefinitely and that insecticide treatment may have to be continued until the present wood inventory on protected acres has been harvested. If the outbreak were to continue beyond 5 years and insecticide treatments were to be halted at the end of 5 years, little or no benefit would be derived from investment in the first 5 years of insecticide treatment (Appendix E Tables 1, 2, 3, and 4).

Whether all of the existing fir timber being protected can be harvested is uncertain. According to a survey of several woodland owners, 21 to 30 years would be needed to harvest only one-half of the mature fir volume at the 1978 rate of harvest and nearly 100 years would be required to harvest 90 percent of this volume, leading to a strong possibility that much of the existing volume would die of old age (Field 1980). A dilemma exists however, in that without protection, much would die at an earlier age. These findings apply to most of the spruce-fir type in Maine, whereas a protection program would be applied to a smaller area, probably increasing the likelihood that most protected fir could be harvested before it dies of old age. However, some tree mortality from non-budworm causes is expected even in protected areas.

Rate of harvest is considered in determining how much acreage needs to be protected. Harvested areas clearcut or from which fir has been removed may no longer require protection. Therefore, costs of protection decrease over time to the extent that stands are no longer vulnerable.

Assumptions about harvest plans used in this analysis are necessarily tentative since landowner plans are confidential. The Maine Bureau of Forestry starting in October 1981, under authority of the new Spruce Budworm Management Act, will require each landowner to provide a 5-year cutting plan and other management information and plans as a requirement for spray program eligibility.

This analysis does not consider on-going management costs such as fire protection, road building, and harvesting. Also, the benefit and costs from intensive silvicultural methods such as precommercial thinning and planting of non-host species are not considered. The Maine Forest Productivity Report (1979) indicates that investment in intensified management of Maine's spruce-fir type would not return at least 8 percent. This report assumed optimum conditions with no loss from budworm.

Because of the long term nature of the spruce budworm problem and possible need for long term investments, the benefit cost analysis is not limited to a 5-year program. The source of funds for the 5-year period or for later protection investments are not a consideration. Only the amounts that may need to be invested annually are considered in the benefit-cost analysis.

Any effects of spruce budworm damage on recreation values, wildlife populations and habitat, or watershed values are not considered. Data is unavailable regarding favorable or adverse effects of spruce budworm damage on these resources and what the effects might be with and without protection. Also, studies in other areas of the country have demonstrated that relative to the value of stumpage, recreation, wildlife and watershed values have a minor influence on benefit-cost calculations (USDA Forest Service, 1977). No monetary losses have been attributed to reductions in populations of non-target invertebrates and for this reason these effects are not considered in the benefit-cost analysis. The cost of EIS preparation is not considered in this analysis.

Tree growth losses were not considered in this analysis because the primary objective of protection in Maine is to prevent tree mortality, not growth loss. Only potential mortality losses with and without protection were used to calculate benefits.

Two discount rates were used for all calculations involving future costs and benefits: 4 percent and 10 percent. The USDA Forest Service has established 4 percent as the discount rate to be used for evaluating public forestry investments (contained in letter from Secretary of Agriculture Bob Bergland to James T. McIntyre, Director of the Office of Management and Budget, June 16, 1979). The Office of Management and Budget has issued a circular indicating a preference for a 10 percent

discount factor (OMB Circular No. A-94, March 27, 1972). Four percent and 10 percent represent a low and high influence useful for comparison purposes. Thus both are used in this analysis.

According to Office of Management and Budget (OMB Circular No. A.94) and USDA Forest Service policy (FSM 3453.16) benefit-cost analyses are restricted to primary benefits and costs since secondary benefits and costs are not easily identifiable. Benefit-cost analysis does not consider such matters as who benefits, whether benefits are equitably distributed or the extent of secondary or regional benefits such as employment and value added. The direct benefits associated with sale of trees that would have been lost without protection are realized by the landowner whose land was protected. Non-industrial landowners may benefit indirectly to the extent that industrial landowners have their lands protected and choose to purchase wood that otherwise would be lost. The secondary economic effects of spruce budworm with or without protection are uncertain because of the large number of factors other than budworm affecting the spruce-fir resource and economy. The spruce-fir industry provides a total annual cash flow into the State's economy of over $800 million (Field 1980). The industry provides employment to several thousand workers in Maine. Canadian citizens also depend on Maine's spruce-fir forest for employment and industry in Canada is dependent on Maine wood. The extent to which these economic facts will change in the long term or short term depends on a large number of factors including degree of budworm protection, effectiveness of this protection, the imbalanced age class distribution of Maine's spruce-fir forest, landowner plans, use of other species, changing utilization standards, and import-export changes.

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APPENDIX F

PREPARERS

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APPENDIX G

GLOSSARY

Acetylcholine
A compound that is released at autonomic nerve endings that functions in the transmission of nerve impulses.

Acetylcholinesterase
An enzyme that accelerates hydrolysis of acetylcholine.

Active ingredient (a.i.)
The effective part of the pesticide formulation, or the actual amount of the pesticide present in the formulation.

Acute toxicity
The toxicity of a compound in a single dose or in multiple doses over a period of 24 hours or less.

Apiary
A place where bees are kept.

Arachnida
Class of arthropods including spiders and mites.

Benthic organisms
The plants and animals at the bottom of a body of water.

Biomass
The amount of living matter in a particular habitat usually expressed as weight of organisms per unit area of habitat or as volume or weight of organisms per unit volume of habitat.

Bt
Bacillus thuringiensis: A bacterium used as a biological control agent for Lepidopteran pest species.

Buffer zones
Areas intended to receive only spray drift fallout from the application site.

Caddisfly
A small moth-like insect. The larvae live in fresh water in portable cases they construct around themselves. Member of order Trichoptera.

Carcinogenicity
Tendency of a substance to produce cancer.

Char
Any of a genus of trout.

Chitin
A semitransparent horny substance forming the principal component of crustacean shells, insect exoskeletons and the cell walls of certain fungi.

Chitinase
An enzyme that hydrolyzes chitin.

Cholinesterase
Any of several enzymes that hydrolyze acetylcholine.

Chronic toxicity
The effect of a compound on test animals when exposed to sub-lethal amounts continually.

Collembola
Springtails. Primitive, wingless insects commonly found in soil and litter.

Critical Fishery Area
A "Critical Fishery Area" in spruce budworm suppression operations is defined as any water area flowing or standing and adjacent land areas in the same watershed, where treatment with toxic chemicals presents a potential risk of adversely affecting significant sport fisheries and/or other aquatic resources. Identification of critical areas and determination of their biological significance is made by regional Maine Department of Inland Fisheries and Wildlife biologists most familiar with the Fisheries involved, based upon the best scientific knowledge available.

"Critical Fishery Areas" may include but are not limited to:

(1) Areas where uncommon or unusual fish species or populations are present (e.g. Sunapee and Blueback chars).
(2) Hatchery water supplies where fish production might be endangered.
(3) Surfaces of, and land areas adjacent to, flowing and standing waters where significant sport fisheries exist for warmwater and/or coldwater fish.
(4) Surfaces of, and land areas adjacent to, water containing significant spawning and nursery areas for warmwater and/or coldwater fish.
(5) Waters and adjacent land areas where fishery research is currently being conducted.
(6) Waters being managed under the Atlantic Sea Run Salmon Restoration Program.

This definition was provided by the Maine Department of Inland Fisheries and Wild Life.

Degradation
The process of break down, decomposition.

Ephemeroptera
Mayflies. Insects with an aquatic nymphal stage and a short-lived adult stage having membraneous wings.

Endangered species
A species, or sub-species, of animal or plant whose prospects of survival and reproduction are in immediate jeopardy. It must be designated in the Federal Register by the appropriate Department Secretary as an "endangered species".

Fir-only harvest
The commercial removal of balsam fir from a spruce-fir stand to reduce vulnerability to spruce budworm and accelerate growth of the residual stand.

Formulation
The form in which a pesticide is packaged or prepared for use.

Growing stock volume
Volume of wood contained in live trees of commercial species that are classified as sawtimber or poletimber, that is, all live trees of commercial species, 5" dbh or larger, except rough and rotten trees.

Half-life
The time required for half the amount of a substance (as a drug or radioactive tracer) to deteriorate by excretion, metabolic decomposition, or other natural process.

Harvest
A loose term for the removal of trees from the forest, for product utilization.

Hemiptera
True bugs. Group of insects with semi-toughened forewings.

Hymenoptera
A large order of insects including the ants, bees, sawflies and wasps. The typical adults have four membranous wings and chewing type mouthparts.

Inaccessible
Areas which are currently not harvestable because of lack of roads.

Insect growth regulator (IGR)
Chemical substances which disrupt the action of insect hormones controlling molting and maturation from larval to adult stage.

Integrated Pest Management (IPM)
The President's 1979 Environmental Message to Congress described IPM as "a systems approach to reduce pest damage to tolerable levels through a variety of techniques including predators and parasites, genetically resistant hosts, natural environmental modification, and, when necessary and appropriate, chemical pesticides".

Larva (plural larvae)
An early stage of insect development, after hatching from the egg and before changing into a pupae, a caterpillar, maggot or grub.

LC_{50}
Median lethal concentration is the concentration (ppm or ppb) of a toxicant in the environment (usually water) which kills 50 percent of the test organisms exposed.

LD_{50}
Median lethal dose is the milligram of toxicant per kilogram of body weight (mg/kg) lethal to 50 percent of the test animals.

Lepidoptera
A large order of insects, including the butterflies and moths, characterized by four scale-covered wings and coiled sucking mouthparts.

Mg/kg
Milligrams per kilogram is used to designate the amount of toxicant required per kilogram of body weight of test organisms to produce a designated effect, usually the amount necessary to kill 50 percent of the test animals. One mg/kg = 1 ppm. One mg = 0.000035 ounce, and 1 kg = 2.2 pounds.

Mg/kg/d
Milligrams per kilogram per day.

Mutagenicity
The capacity of a substance to cause changes in genetic material.

Non-persistent
Only lasts a short time (a few weeks or less) after being applied, breaks down rapidly in the environment.

Oligochaete
Terrestrial or aquatic segmented worms such as earthworms.

Passerine birds
Birds of the order Passeriformes. Perching birds.

Pheromones
Volatile chemicals released externally by an insect that induces specific behavioral responses when detected by another individual of the same species.

Plecoptera
Stoneflies. The nymphs are aquatic and mostly phytophagous.

Polyphagous
Literally "eating many". The ability to survive on a wide variety of foods.

Precommercial thinning
The non-commercial felling of trees in an immature stand in order to accelerate growth, increase vigor, and reduce the vulnerability of the residual stand.

Pre-salvage
The commercial harvest before insect-caused mortality occurs in highly vulnerable or dying trees.

Predator
An animal that preys on other animals.

ppb
Parts per billion is the number of parts of toxicant per billion parts of diluent. One ppb = 1 ug/liter (water or air).

ppm
Parts per million is the number of parts of toxicant per million parts of diluent. One ppm - 1 mg/kg (on weight basis) = 1 mg/liter (liquid).

Regulated forest
A forest with age and size classes represented in such proportions, consistently growing at such rates that an approximately equal annual yield of wood is obtained when those individual size classes have matured and are harvested.

Residue
The amount of pesticide that remains on a crop, animal, or surface for a while after it has been treated. Not the same as spray deposit.

Resistance
Resistance to chemical insecticides is the development of an ability in a strain of insects to tolerate doses of toxicants which would prove lethal to the majority of individuals in a normal population of the same species.

Rotation
The period of years between the initial establishment of a stand of timber and the time when it is considered ready for cutting and regeneration. The length of rotation may vary depending on the species and product desired.

Salvage
The commercial harvest of dead or deteriorating trees before the wood becomes unuseable.

Sarcophagidae
Flesh flies. Larvae feed on animal materials and adults on sweet materials.

Sensitive area
An area where insecticide contamination is not desired.

Scoping
As defined under the National Environmental Policy Act - an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action. This may include a public meeting whereby the significant issues are identified. These issues are considered later in the environmental analysis.

Silviculture
The theory and practice of controlling the establishment, composition and growth of forests.

Spray block
A land area or unit designated for spraying.

Spray deposit
That portion of a spray cloud that reaches a target surface.

Spruce-Fir Protection District
An area in Maine established by State law for administration of a spruce budworm management program consisting of the municipalities and townships in which the softwood forest is substantially spruce-fir. In October 1981 when the new budworm law goes into effect this area will no longer be referred to as the Spruce-Fir Protection District. However spruce budworm management activities will continue to be directed to threatened stands within the area now referred to as the Spruce-Fir Protection District.

Stumpage value
Value of standing timber at time of harvesting.

Susceptibility
The probability of a forested area being attacked by the spruce budworm.

Sustained yield
The yield that a forest can produce continuously at a given intensity of management where growth and cutting are balanced.

Tachinidae
Family of flies. Some species have parasitic larvae.

Teratogenicity
The capacity of a substance to cause anatomical, physiological or behavioral defects in animals exposed during embryonic development.

Threatened species
Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range and which has been designated in the Federal Register by the appropriate Department Secretary as a threatened species.

Utilization-marketing
The creation of a product from available wood fiber at a competitive price with an adequate margin for profit.

Vulnerability
The probability of damage resulting from attack by the spruce budworm.

APPENDIX H

MAINE SPRUCE BUDWORM SUPPRESSION ACT

In April 1980, the 109th Maine Legislature amended the Spruce Budworm Suppression Act enacted in 1976. This law, as amended, will continue in effect until September 30, 1981.

At the same time, the 109th Maine Legislature enacted the Maine Spruce Budworm Management Act to take effect starting Octoberl, 1981 (Appendix I).

APPENDIX H

SUBCHAPTER IV SPRUCE BUDWORM SUPPRESSION ACT

Section 8401. Short title

The subchapter shall be known and may be cited as the "Maine Spruce Budworm Suppression Act."

Section 8402. Legislative policy

The Legislature declares that it shall be the policy of the State to undertake reasonable measures to control and suppress infestations of spruce budworm insects in the spruce and fir forests of the State during the years 1976-1981, including such measures as the minimization and equitable distribution of the burden of losses attributable to budworm infestation, the maintenance of wood resources sufficient to permit the forest products industries of the State to operate as near to full production capacity as would be possible but for the existence of the budworm infestation; accomplishment of the maximum sustained yield harvest possible; utilization of the most cost-effective methods of budworm protection and control; and as the financing of the state share of suppression and control measures by the General Fund of the State of an extent commensurate with the public benefit accruing from a suppression and control program and by excise taxes on the privilege of owning and operating such forest land for the services of protection rendered to the forest lands to an extent commensurate with the benefits accuring to the owners of the lands from such a program.

Section 8403. Definitions

For the purposes of this subchapter, unless the context otherwise indicates, the following words shall have the following meanings.

1. Contiguous. "Contiguous" means in actual contact. Contiguous parcels of land are those which share a common boundary whether acquired by one or more deeds. Roads, streams and natural features shall not be deemed to interrupt a boundary which would otherwise be common.

2. Forest land. "Forest land" means land in contiguous parcels which are subject to mandatory taxation purusnat to Title 36, chapter 105, subchapter II-A.

3. Hardwood. "Hardwood" means forest land on which maple, beech, birch, oak, elm, basswood, poplar and ash, singly or in combination, comprise 75% or more of the stocking.

4. Mixed wood. "Mixed wood" means forest land on which neither hardwood or softwood comprise 75% of the stand but are a combination of both.

5. New market. "New market" means a wood-processing plant which did not utilize budworm infested or damaged wood on or before January 1, 1976 or the physical expansion of an existing wood processing plant, which expansion did not utilize budworm infested

or damaged wood on or before January 1, 1976. The volume of spruce and fir used by an expanded wood processing plant in any one year shall have subtracted from the volume the average annual volume of spruce and fir utilized by that plant during the calendar years 1973-1975 to determine the volume which represents a new market.

6. Nonfederal share per acre. "Nonfederal share per acre" means the total amount of money raised from General Fund appropriations and excise tax revenues provided for the suppression and control of spruce budworm divided by the number of acres within the designated spray area.

7. Person. "Person" means any individual, partnership, joint venture, corporation or other legal entity, or any group of persons which acts as a tenancy in common or joint tenancy, for ownership purposes, except any government or any agency, bureau or commission thereof.

8. Rebate. "Rebate" means a payment by the State back to a person subject to taxation pursuant to this subchapter.

9. Rule. "Rule" means a duly adopted regulation of the Bureau of Forestry of general applicability. Such rules shall have the force and effect of law.

10. Sawlog. "Sawlog" means a log suitable in size and quality for producing one or more of the following products: Veneer, sawn boards and sawn timber.

11. Softwood. "Softwood" means forest land on which pine, spruce, fir, hemlock, cedar and larch, singly or in combination, comprise 75% or more of the stocking.

12. Spray project. "Spray project" means all operations connected with the application of insecticides or other materials against spruce budworms or bud moths within a single year.

13. Spruce budworm. "Spruce budworm" means the insect of the species known as choristoneura fumiferana, Clem., at any stage of its biological development.

14. Wood Classification. "Wood classification" means the typing of forest land into the categories of hardwood, mixed wood and softwood.

Section 8404. Spruce Fir Forest Protection District

There is established a Spruce Fir Forest Protection District consisting of the following municipalities and townships:

Aroostook County. All municipalities and townships except the following: Caribou, Easton, Fort Fairfield, Fort Kent, Frenchville, Houlton, Limestone, Littleton, Madawaska, Mapleton, Mars Hill, New Limerick, New Sweden, Oakfield, Presque Isle, Washburn and Woodland;

Franklin County. The following municipalities and townships: Alder Stream, Chain of Ponds, Coburn Gore, Coplin Plantation, Dallas, Eustis, Jim Pond, Lang and Rangeley;

Hancock County. All municipalities and townships north and east of a line formed by the northern and eastern boundaries of the following municipalities and townships: Otis, Ellsworth, T.8,S.D., Hancock, Sullivan and T.7,S.D.; except the following: T.9,S.D.; and T.10,S.D.

Penobscot County. All municipalities and townships north of a line formed by the southern and western boundaries of the following municipalities: Bradley, Clifton, Milford, Argyle, Alton and Lagrange;

Piscataquis County. All municipalities and townships, except the following: Abbot, Atkinson, Dover-Foxcroft, Guilford, Kingsbury, Milo, Monson, Parkman, Sangerville, Sebec and Wellington;

Somerset County. All municipalities and townships north and east of a line formed by the southern and western boundaries of the following municipalities and townships: Mayfield, Moscow, Pleasant Ridge Plantation, Carrying Place, T.3,R.4, B.K.P., W.K.R. and Flagstaff, except for the following: T.5,R.6, B.K.P., W.K.R.; and

Washington County. All municipalities and townships, except the following: Addison, Beals, Cutler, Eastprot, Harrington, Jonesport, Lubec, Machias, Machiasport, Milbridge, Roque Bluffs, Steuben and Trescott.

Section 8405. Funding

1. Advance budget planning. The Director of the Bureau of Forestry shall annually, prior to January 1st of each of the years 1977-1981, certify to the Bureau of the Budget his estimate of the cost, if any, of the nonfederal share for the implementation of this Part for the calendar year following that legislative session. The Bureau of the Budget shall include this recommended amount in the Part I budget. The Legislature shall annually, in its Part I budget, determine the amount, if any, which shall be expended for this program and the manner in which the amount shall be funded. The determination shall authorize the budworm suppression program provided for by this subchapter for such calendar year and shall supersede any requirements which may exist for the approval of this program by any other state agency. In the event that the director subsequently determines that the amount necessary to conduct the activities authorized by this subchapter in any calendar year exceeds the amount appropriated in the Part I budget, he shall inform the Bureau of the Budget and it shall certify the additional amount necessary. Any such additional amount shall become a part of the Part II budget, subject to increase, reduction or approval by the Legislature.

2. General Fund. On or before January 1, 1977, and on January 1st for the 4 years thereafter, the Commissioner of Conservation shall report in writing to the Legislature, recommendations of the department as to the percentage of the cost of the annual program for the control and suppression of spruce budworm which the Department of Conservation recommends to be paid out of the General Fund and the percentage from excise or other tax funds during 1977 and 1978 in the first instance and thereafter for the calendar year following the legislative session, the percentages to be based upon the benefits to the State and to private landowners, respectively. Prior to making the recommendations, the commissioner shall hold a public hearing to provide opportunity for public comment on these matters. Money appropriated from the General fund for these purposes shall be paid into the budworm suppression Fund hereinafter established.

3. Excise tax funds. Persons owning parcels of forest land, including persons claiming timber and grass rights in public reserved lands, which are classified as forest land pursuant to Title 36, chapter 105, subchapter II-A, of more than 500 acres within the Spruce Fir Forest Protection District shall be subject to the pre-project and post-project excise taxes established under section 8406 on the privilege of owning and operating such parcels of forest land, except as provided in this subchapter. In cases of divided ownership of the forest land, the persons owning or claiming timber rights in such forest land shall be subject to such taxes. The Legislature hereby finds that it would not be administratively feasible to apply such taxes to smaller parcels of such forest land.

4. Spray project special accounts. Accounts shall be established in the following manner.

A. The Treasurer of State shall establish 2 dedicated revenue accounts as follows.

(1) Into one account shall be deposited any revenues received by the State from the Government of the United States for any spray project.

(2) Into the other account shall be deposited any revenues received by the State from the excise taxes authorized pursuant to this subchapter.

B. The moneys credited to these accounts shall be used by the Bureau of Forestry to pay any expenses, debts, accounts and lawful demands incurred in connection with spray projects authorized under this subchapter and the director shall authorize the State Controller to draw his warrant therefor at any time. Any remaining balance in these accounts shall continue from year to year as a fund available for the purposes set out in this subchapter and for no other purposes.

5. Borrowing from General Fund. To accomplish the purposes of this subchapter, the director may, subject to the approval of the Governor, borrow moneys from the General Fund for up to 120 days, at no interest, in order to enable the bureau to pay expenses, debts, accounts and lawful demands for any spray project authorized under this subchapter; provided, however, that the aggregate amount of that borrowing may not, at any time, exceed the amount of uncollected excise taxes authorized under this subchapter for such spray project.

Section 8406. Taxation

1. Pre-project excise tax. The pre-project excise tax on parcels of softwood forest land shall be $1.45 per acre for 1980 and 1981. The pre-project excise tax on parcels of mixed-wood forest land shall be 72½¢ per acre for 1980 and 1981. The tax shall be assessed and billed by the State Tax Assessor within 30 days following the effective date of this section for 1980, and on or before April 1, 1981.

2. Post-project excise tax. The post-project excise tax on forest land shall be computed and assessed as follows.

A. The Director of the Bureau of Forestry shall determine the total amount of costs incurred or budgeted to be expended in connection with any spray project conducted during the 1980 and 1981 calendar years.

B. The amount computed in paragraph A for each of the years 1980 and 1981 shall be reduced by the amount of any moneys received for such project from the Government of the United States and from contract payments made for spraying services pursuant to section 8414, subsection 3.

C. 90% of the balance computed under paragraph B shall be raised by a post-project spray tax, the per acre rate of which shall be calculated by dividing the sum to be so raised by the number of acres, subject to excise taxation under this subchapter, which actually received spray treatment in 1980 and 1981.

D. 10% of the balance computed under paragraph B shall be raised by a post-project shared tax, applicable to all taxable acres in the district, the per acre rates of which shall be calculated in accordance with the following:

Each taxable acre in the district which is classified as mixed wood shall be taxed at half the rate applicable to each taxable acre in the district classified as softwood; and each such acre classified as hardwood is not subject to taxation under this paragraph.

E. The director shall certify in writing to the State Tax Assessor, by September 1st, the post-project shared tax rates for softwood and mixed-wood acres and the post-project spray tax rate, together with the number of acres within each ownership which are subject to such taxes.

F. The amount of the post-project excise taxes payable by each landowner shall be reduced by the amount assessed upon that landowner on account of the pre-project excise tax payable for that calendar year.

G. The State Tax Assessor shall compute, assess and bill, by September 30th the amount of post-project excise taxes payable by each landowner in accordance with this section.

Notice of the amount owed by each landowner shall be sent to him or his agent at the address shown on the records of the State Tax Assessor or of the municipality in which the land is located. In the event that the amount so calculated results in a negative balance for any landowner, the State Tax Assessor shall refund to that landowner the amount of the balance in the form of a tax rebate. The rebate shall be made no later than February 28th of the year following the assessment date.

3. Due date. The pre-project excise tax is due June 30th of the year in which it is assessed. The post-project excise tax is due December 31st of the year in which it is assessed. Notice of the taxes shall be presumed complete upon mailing.

4. Interest and penalty. Any tax assessed under this subchapter which is not paid when due shall accrue interest at the rate of 1½% for each month, or fraction thereof, that the tax remains unpaid and a penalty equal to 20% of the unpaid tax shall be added to the liability of any person who fails to pay a tax when due.

5. Lien. There shall be a tax lien on all land subject to taxation under this subchapter to secure the payment of all sums due hereunder, and the lien may be enforced in the manner provided by Title 36, sections 1282 and 1283.

6. Collection by Attorney General. Whenever any person fails to pay any tax, interest and penalty due under this subchapter within the time provided, the Attorney General shall enforce payment by civil action against the person from whom it is due for the amount of such tax, interest and penalty, together with costs, in either the Superior or District Court in Kennebec County or in the judicial division in which the person has a residence or established place of business.

Section 8407. Designated spray areas

1. Designation. The director shall, not later than October 15th of each year, designate the areas of the State upon which it is, in his judgment, necessary to apply chemical, biological or other material in order to suppress and control spruce budworm infestations. The designations made by the director shall be on the basis of data compiled for the Bureau of Forestry including, but not limited to, egg mass counts, evidence of defoliation, tree vigor, timber cruises, photography and similar information. The director shall provide forest land owners in the Spruce Fir Protection District with an opportunity to submit their recommendations and any information in support thereof with respect to what areas should be designated.

The director shall annually prepare maps showing the areas designated for spraying by him in the following year by the dates first stated in this section and shall report in writing the number of acres in each township designated for spraying.

2. Notice. Within 10 days of the preparation of the maps and reports required by subsection 1, the director shall cause to be published in the state paper and such other newspapers as he deems appropriate, notice of the designation of the spray areas pursuant to this section. The notice shall state that the designation is complete, shall indicate locations where area maps will be available for inspection and where further information may be obtained, and shall provide information concerning withdrawal procedures pursuant to sections 8408 to 8409.

Section 8407-A. Settlement corridors

1. Designation. All land within 2 miles of publicly-maintained roads in the Spruce Fir Forest Protection District shall be designated by the Director of the Bureau of Forestry as settlement corridors. That designation shall be made to the State Tax Assessor by August 1, 1980.

2. Insecticide spray treatment; exceptions. Land within settlement corridors may not receive insecticide spray treatment except under the following circumstances:

A. The landowner makes a written request for that treatment in accordance with schedules and procedures adopted by the director;

B. The request is accompanied by such information as the director may require and meets criteria as the director may adopt in furtherance of the legislative policies of this subchapter; and

C. The request does not relate to land within a settlement corridor located in a municipality which has taken action to prohibit spray projects within that corridor pursuant to subsection 4.

3. Director's authority. The provision for settlement corridors under this section does not impair or affect the director's authority to define and carry out other policies and procedures, including, without limitation, the use of no-spray buffers, designed to protect the public health and the environment, as he deems necessary or appropriate.

4. Prohibition by municipalities. Any municipality within the Spruce Fir Forest Protection District may prohibit the execution of spray projects authorized under this subchapter within settlement corridors, as designated pursuant to this section, which lie within that municipality. Any such prohibition, or the repeal thereof, may be enacted in accordance with the procedures for enactment of municipal ordinances; provided that any such prohibition shall be enacted before April 15th of any calendar year in which it shall apply and that the municipality shall send a certified copy of its enactment to the director within 5 days following the adoption of the same.

5. Tax levy. No tax levied pursuant to section 8406 may be assessed on lands within settlement corridors for which the execution of spray projects has been prohibited by a municipality as provided in subsection 4.

Section 8408. Automatic withdrawals

1. Conditions. Any person owning or claiming rights in timber or land within the Spruce Fir Forest Protection District and subject to taxation hereunder may, by November 15th of each year, apply in writing to the director for the withdrawal of not less than 500 acres nor more than 1,000 acres. Each person who is an owner or claimant of real estate shall be entitled to only one withdrawal pursuant to this section and all acres withdrawn shall be contiguous.

2. Consent. Applications made pursuant to subsection 1 shall be granted by the director when he is satisfied that the information contained in the application is complete, truthful and accurate. In the event that he is not so satisfied within 30 days after submission of an application, it shall be deemed denied and the director shall state his reason for denial in writing to the applicant. Upon the granting of an application, the director shall notify the State Tax Assessor.

3. Tax exemption. Lands withdrawn pursuant to this section shall not be subject to taxation under this subchapter for the years in which such withdrawal is accepted. The director shall certify on or before December 31st of each year, to the State Tax Assessor and the acreages and owners exempt from taxation under this section.

Section 8409. Silvicultural treatment designation

1. Conditions. Any person owning or claiming rights in timber on land within the Spruce Fir Forest Protection District and subject to taxation hereunder may, by November 15th of each year, apply in writing to the Director of the Bureau of Forestry for designation of contiguous parcels of land of not less than 500 acres as silvicultural treatment areas. Designation as a silvicultural treatment area shall be granted only upon the submission and approval of a plan for the area which provides for the adoption of silvicultural practices designed to minimize susceptibility and vulnerability to future spruce budworm infestations as those practices are defined by the rules.

2. Consent. Applications made pursuant to subsection 1 may be granted, or granted conditionally, by the director when he is satisfied that the information contained in the application is complete, truthful and accurate and that the plan submitted conforms with the rules relating to such designation. In the event that the director is not so satisfied with 60 days after the submission of the application, it shall be deemed denied and the director shall state his reasons for the denial in writing to the applicant.

3. Tax exemption. Lands designated by the director pursuant to this section shall be exempt from taxation under this subchapter so long as they retain such designation. For applications for designation made by April 25, 1976, if acceptance occurs after the tax imposed by this subchapter has been paid, the Treasurer of State shall rebate the tax payments out of the Budworm Suppression Fund. The parcels shall be exempt from taxation pursuant to this subchapter so long as they retain the designation. In the event that the director finds that the owner or claimant is in noncompliance with the terms upon which the application was granted, then an amount equal to the tax, interest and penalty as provided for in section 8406, subsection 6, for each year the parcel was designated as a silvicultural treatment area shall immediately become due and payable and his land shall be subject to a lien as provided for in section 8406, subsection 7.

Section 8410. General conditions for withdrawals

1. Forms. All applications for withdrawals and designations pursuant to sections 8408 to 8409 shall be made on forms prepared under the supervision of the director and shall contain the following information:

A. The number of acres which are the subject of the application;

B. The timber types thereon;

C. Their location on maps of the same size and scale as those accepted by the State Tax Assessor in the administration of the Tree Growth Tax Law;

D. Statement of ownership rights therein;

E. Subject to the provisions of paragraph G, written authorization from each owner of, or claimant to, an interest therein, other than owners of easements and mortgages;

F. Any other information relating to the suitability of the parcel for withdrawal or designation as the director may require, including, but not limited to, the age of the stands within the acreage, the timber volumes to be removed, the budworm hazard classes of the stand therein, management plans therefor and the basis for the application for withdrawal or designation; and

G. In the case of applications for parcels of land within townships or portions of townships which are held in common and undivided ownership, the owners of a controlling interest in the parcel shall have the power to make applications authorized under this subchapter and the decisions of the director shall be binding on all owners of interests therein.

2. Limitations. The director shall not accept, nor shall he consider, any application for withdrawal or designation pursuant to sections 8408 to 8409 for any acre of land for which withdrawal or designation pursuant to any other of the aformentioned sections already has been granted.

3. Prohibition. No parcel of land for which withdrawal or designation has been granted pursuant to sections 8408 to 8409 shall be sprayed with insecticides by the Bureau of Forestry for the purpose of suppressing spruce budworm populations at any time following the grant, except following a finding by the director that the land has not been operated in accordance with an application or its rules, or as provided in subsection 4 or in section 8413, subsection 4.

4. Petition. A landowner who determines that, notwithstanding the implementation of a plan accepted by the director, there exists a need for the application of insecticides, may petition the director for inclusion in future spray projects. In the event that the director accepts the petition, the applicant shall be assessed for excise taxes due for the year in which the application for exemption was made and each year thereafter. The director shall reject any petition made for the purpose of evading penalties for which the applicant might otherwise be liable for failure to comply with a plan submitted pursuant to section 8409 or the rules pertaining thereto.

5. Written notification. Owners of tracts under silvicultural or automatic withdrawals shall send written notification to the director within 30 days of any transfer of any interest, other than an easement or mortgage, in those tracts.

Section 8411. Duties and authority of the Director of the Bureau of Forestry

1. General. The director shall coordinate the activities of the bureau personnel and render all assistance practicable to the Committee on Spruce Fir Silviculture.

2. Rules. From time to time he shall adopt and amend rules for the implementation of this subchapter consistent with section 8413. These rules shall be adopted in accordance with the procedures set forth in Title 5, chapter 375, subchapter II.

3. Applications. He shall consider applications made pursuant to sections 8408 to 8409 and grant, conditionally or deny such applications.

4. Reduction. In the event that the director determines that the total number of acres remaining within the spruce fir forest type after applications have been made is not sufficient to provide the amount of wood necessary to meet the reasonably foreseeable future need for spruce and fir in the State, then he may reduce the acreage included in each otherwise acceptable application made pursuant to section 8409 in equal portions so that the total number of acres withdrawn does not exceed the number he deems necessary to supply such wood.

5. Declaration of termination of infestation. Upon receipt of satisfactory information to the effect that the severity of the infestation of spruce budworm has declined to the extent that no spray program will be beneficial or cost effective in all the years remaining during which this Part is in effect, he shall report the same to the Commissioner of Conservation and the Governor and shall recommend to the Legislature that it declare a termination of infestation.

6. Markets and utilization. He shall have the authority to conduct and contract for research relating to the marketing and utilization of wood resources which are or may be affected by spruce budworm infestation.

7. Entry and inspection. The director may enter, upon reasonable advance notice to the landowner, at any reasonable time in a reasonable manner, any tract of land for which application pursuant to sections 8408 to 8409 has been made or granted in order to inspect the same free of any charge or cost imposed by the owner or his agents to assure compliance with the rules and order of the director.

8. Inspection. The director or his duly authorized representatives may likewise inspect the books and records of any applicant with respect to any information set forth in an application or verification thereof. He also may require periodic progress reports from applicants in connection with his verification procedures.

9. Reimbursement to state agencies. Out of funds available for any spray project, the director, subject to the approval of the Governor, may reimburse other state agencies for costs incurred by them in connection with that spray project. Such cost may include, but shall not be limited to, those incurred for environmental and health monitoring and regulation. Any department or agency of State Government is authorized to accept funds which may be available for carrying out the purposes of this subchapter.

10. Removal of lands from the spray application. Upon application of a forest landowner received no later than April 1, 1980, for the 1980 spray project and December 31, 1980, for the 1981 spray project, the director shall withdraw lands of that owner from spray application. Those lands shall remain subject to the pre-project excise tax and to the post-project shared tax.

Section 8412. Committee on Spruce Fir Silviculture

1. Committee created. To perform the duties specified in this subchapter, there is established a Committee on Spruce Fir Silviculture.

2. Membership. The committee shall consist of 5 citizens of the State at least 3 of whom shall be registered foresters who are knowledgeable as to commercial forest land management. They shall be appointed for a term of 2 years each by the Commissioner of Conservation with the advice and consent of the Governor. Each member shall be entitled to his actual expenses and $50 per diem to be drawn from the Budworm Suppression Fund. They shall be subject to removal for cause by the commissioner with the approval of the Governor.

3. Duties. The Committee shall carry out the following duties:

A. Elect one of its members to serve as chairman for the year in which the election is conducted;

B. Approve the rules to be issued pursuant to sections 8411 and 8413;

C. Determine appeals as provided in section 8418, subsection 2; and

D. Provide advice and consultation to the Director of the Bureau of Forestry with respect to the subject matter of this subchapter.

Section 8413. Rules relating to silviculture

1. Purpose. The director shall adopt and may, from time to time, amend and repeal, subject to the approval of the Committee on Spruce Fir Silviculture, rules to carry out the purposes of this subchapter including, but not limited to, rules relating to the qualifications of parcels of forest land for silvicultural treatment designation.

The purpose and scope of the rules shall be to reduce the vulnerability and susceptibility of the Maine spruce fir forest to spruce budworm depredations, to reduce the economic losses to the State from such depredations as do occur and to assure future supplies of spruce and fir. The rules shall establish standards for forest management including, but not limited to, timber stand improvement and harvesting in accordance with sound silvicultural principles. Economic considerations as well as all other relevant considerations shall be taken into account in determining the rules. The director shall promulgate only those rules directly related to the foregoing purposes. In particular, it is not the intent of this subchapter to regulate operational techniques including, but not limited to, road layout and construction, equipment use and erosion control.

2. Silvicultural designation rules. The director shall adopt rules relating to the eligibility of parcels of land for designation as silvicultural treatment areas to fulfill the objectives of subsection 1 including, as appropriate:

A. Standards for cutting by selection, shelterwood, clearcutting and such other methods as the director may allow including, but not limited to, the number of cuts, diameter and volumes under reasonable classifications of site conditions;

B. Minimum standards for seed tree retention including the number and location per acre under reasonable classifications of cutting methods and site conditions; and

C. Silvicultural practices reasonably related to the alteration of stand composition and the thrift and vigor of the resulting stand.

3. Spraying rules. The director may make rules requiring the mandatory inclusion of parcels within the designated spray area when, in his judgment, the action is necessary because of the intensity of the infestation or because it would be excessively costly or logistically difficult to avoid applying insecticides and for like reasons.

4. Verification. The director also may make rules for verification of compliance with the rules promulgated hereunder.

Section 8414. Forest Insect Manager

1. Position created. There is established within the Bureau of Forestry the position of Forest Insect Manager. Such position shall not be subject to the Personnel Law and shall terminate upon the expiration date hereinafter provided for by this Part. The manager shall be appointed by the Director of the Bureau of Forestry with the approval of the Commissioner of Conservation and may be removed by the director with approval of the commissioner. He shall be directly responsible for the development, coordination and implementation of policies and programs of the State as they relate to the control and suppression of the spruce budworm epidemic. The Forest Insect Manager shall also be known as the coordinator of the spruce budworm program.

2. Contractual authority. The manager shall have the authority to enter into and administer contracts for the acquisition of chemicals, aircraft, personnel services and other goods and services necessary to carry out spruce budworm suppression operations subject to the provisions of Title 5, chapters 145 and 155.

3. Spraying services. The manager shall have the authority to enter into and administer contracts to spray with insecticides or similar materials parcels of spruce-fir forest land outside the designated spray area upon application for the provision of the services by the owner of the parcel, provided that:

A. The application is submitted within 30 days of the notice provided for in section 8407, subsection 2, for inclusion in spray projects in subsequent years;

B. He is satisfied that the area for which the application is made can benefit from the spraying and that spraying is practical; and

C. The applicant enters into a contract with the Bureau of Forestry to pay the actual per acre cost to the bureau to spray the land, less any amount which may be provided by the Government of the United States and less the amount of any excise tax paid or assessed under this subchapter on the parcel for the year in which spraying actually takes place.

Forest land under these contracts shall be included in Maine's spruce budworm suppression program.

4. Executive Director

A. The manager shall serve as Executive Director of the Committee on Spruce Fir Silviculture and carry out such duties as the committee may assign to him.

B. He shall certify to the State Tax Assessor on December 31st of each year the specific acreages, their locations and owners exempted by the director from liability for excise taxes pursuant to sections 8408 and 8409.

C. He shall certify any parcels which the director has found to be in noncompliance with an accepted application or its rules and therefore liable to taxation and penalties and any parcels which are liable to taxation pursuant to section 8410, subsection 4.

5. Cooperation. The manager shall consult with and cooperate with the United States Forest Service, the federal government of Canada, the governments of the Provinces of Quebec and New Brunswick and public and private landowners in Maine in developing joint research and operations projects to control and suppress spruce budworm infestations and on related matters.

6. Report. The manager shall, each year after the completion of a spray program, make a complete financial review of the program, and make a full report to the next session of the Legislature. The report shall include, but not be limited to, source of funding, private, state or federal, and total expenditures broken down in the following categories: Chemicals, aircraft, research and other appropriate categories. Also to be included shall be a statement of any remaining balance by source, private, state and federal.

Section 8416. Other state and municipal agencies.

1. Withdrawal. The chief executive officer of any state agency, authority, commission or that of any county or municipality, may withdraw any land, within the ownership or control of the agency, from the designated spray area upon application to the director in the form provided for by section 8410, subsection 1, within 30 days after notice, pursuant to section 8407, subsection 2.

2. Research on public lands. The commissioner or director of any agency of the State with jurisdiction over public land may make the land available on such terms and conditions as he deems reasonable to any public or private nonprofit entity engaged in spruce budworm control research and related silvicultural research. The Forest Insect Manager shall likewise encourage private landowners within the State to make their lands available for the same purposes.

Section 8417. Research

The Bureau of Forestry, acting through its director, may make grants of funds and enter into contracts for purposes of research related to forest management strategies, insecticide and spray application technologies, integrated pest management techniques, forest product marketing and utilization and other issues pertinent to the purposes of this subchapter. This research shall be funded out of moneys available to the director for that purpose.

Section 8417-A

1. Implementation. The Bureau of Forestry shall undertake to develop and implement budworm management technical assistance programs for small woodlot owners.

2. Analysis of future supply and demand. The Bureau of Forestry shall conduct or cause to be conducted an analysis of future supply and demand for the spruce and fir resources of the State. The purpose of this analysis shall be to determine the types and levels of future spruce budworm protection needs and strategies for such spruce and fir resources.

3. Environmental health monitoring. The Bureau of Forestry shall cause to be conducted by an agency other than the Department of Conservation an environmental health monitoring program each year in which a spray project is conducted. The Bureau of Forestry shall prepare and submit an annual report to the Legislature dealing with all aspects of the environmental health monitoring conducted during the previous calendar year.

Section 8418. Appeals

1. Abatement. Any owner or claimant aggrieved by the action of the State Tax Assessor in determining the tax on owners of forest lands, through error or mistake in calculating the same, may apply for abatement of any such excessive tax within 60 days of the notice of the tax and if, upon reexamination, the tax appears to be excessive through such error or mistake, the State Tax Assessor may thereupon abate the excess.

2. Appeal. Any person aggrieved by any final action of the director under this subchapter may take an appeal therefrom within 30 days of the date of the action to the Committee on Spruce Fir Silviculture and the committee may amend or reaffirm the action in accordance with the subchapter and may order such remedial action as is appropriate, including a refund in whole or in part of any taxes, interests or penalties which have been erroneously or unjustly paid. If the committee fails to give written notice of its decision within 90 days of the filing of the appeal, the appeal as provided unless the appellant shall in writing have consented to further delay. The appeal to the committee shall be filed with the Director of the Bureau of Forestry. The committee may adopt reasonalbe rules relating to the conduct of procedure under this subsection.

3. Appeal to Superior Court. Any party may appeal from the decision of the Committee on Spruce Fir Silviculture to the Superior Court in accordance with the Maine Rules of Civil Procedure, Rule 80B.

Section 8419. Review

Chapter 803, subchapter IV, which pertains to establishment, description and participation in the Spruce Fir Forest Protection District, shall be reviewed by the Joint Standing Committee on Appropriations and Financial Affairs during the First Regular Session of the 110th Legislature.

Section 8420. Repeal

This subchapter is repealed on October 1, 1981.

APPENDIX I

SUBCHAPTER IV-A

MAINE SPRUCE BUDWORM MANAGEMENT ACT
(Editor's Note: Goes into effect Oct. 1, 1981)

Section 8421. Short title

This subchaper shall be known and may be cited as the "Maine Spruce Budworm Management Act."

Section 8422. Legislative policy

The Legislature declares that it shall be the policy of the State to undertake a spruce budworm management program to minimize the short-term and long-term impacts of spruce budworm insect infestations upon the State's spruce and fir forests in accordance with the following policy objectives:

1. Supply of wood. The protection of an adequate present and future supply of wood to support the long-term economic needs of the State and of its forest products industries;

2. Development of program. The development and utilization in both the public and private sectors of forest protection and management programs which are cost-effective, biologically sound and responsive to the environmental and health concerns of the public;

3. Reduction in use of insecticides. The reduction in reliance upon the use of chemical insecticides in spruce budworm suppression programs;

4. Private efforts; pest management. The encouragement of private efforts to undertake a variety of integrated pest management techniques which result in a long-term reduction in the susceptibility of the state's forests to spruce budworm infestation and loss;

5. Implementation. The implementation of equitable methods for determining private and public participation in, and financing of, spruce budworm suppression and prevention programs, including provision for voluntary participation in future insecticide spray projects;

6. Regulatory review. The provision for adequate regulatory review of insecticide spray projects by an independent state agency; and

7. Assistance programs. The provision of management and utilization assistance programs for small forest landowners designed to minimize impacts of spruce budworm infestation and loss.

Section 8423. Definitions

As used in this subchapter, the following terms have the following meanings.

1. Commissioner. "Commissioner" means the Commissioner of Conservation.

2. Director. "Director" means the Director of the Bureau of Forestry.

3. Designated spray area. "Designated spray area" means that land area designated by the director, pursuant to section 8424, subsection 4, for inclusion within a spray project.

4. Forest land owners. "Forest land owners" means persons who own forest lands, including, without limitation, persons owning or claiming timber and grass rights in public reserved lands located within that district.

5. Management program. "Management program" means all activities undertaken by the Bureau of Forestry in connection with the short-term and long-term suppression, control and prevention of spruce budworm infestations, including, without limitation, any activities undertaken in connection with spray projects, spruce budworm survey and detection activities, silvicultural, marketing and integrated pest management programs, research and related activities.

6. Person. "Person" means any individual, partnership, joint venture, corporation or other legal entity, or any group of persons which acts as a tenancy in common or joint tenency for ownership purposes, and includes any government or any agency, bureau or commission thereof.

7. Rebate. "Rebate" means a payment by the State back to a person subject to taxation pursuant to this subchapter.

8. Rule. "Rule" means a duly-adopted regulation of general applicability promulgated by the Bureau of Forestry. Such rules shall have the force and effect of law.

9. Spray program area. "Spray program area" means all that forest land for which applications have been made and approved by the director pursuant to section 8424, subsections 2 and 3, except as removed pursuant to section 8425, subsection 2.

10. Spray project. "Spray project" means all activities undertaken or caused to be undertaken by the Bureau of Forestry in connection with the application of insecticides or other materials against spruce budworm insects within a single year.

11. Spruce budworm. "Spruce budworm" means the insect of the species known as Choristoneura fumiferana, Clem., at any stage of its biological development.

Section 8424. Program planning

1. General authority. In accordance with the provisions of this subchapter, the Bureau of Forestry, acting under the supervision of the director, shall be empowered to plan for and undertake activities related to spray projects and management programs on behalf of the State.

2. Application for spray project eligibility. Forest land owners may apply to the director prior to December 1st of any year to be eligible to participate in the spray project for the following year. The application shall show:

A. The name and address of the applicant and its agent, if any;

B. The number and location on maps prescribed by the director of the acres of forest land for which application is being made;

C. The location on maps prescribed by the director of the timber types, timber ages and proportions of spruce, fir and non-host species within such forest land;

D. The location on maps of private and public road access to such forest land;

E. The location on maps of all residences within that forest land;

F. A 5-year cutting plan for such forest land showing plans for timber cutting, road construction and other planned land utilizations; and

G. Any other information pertinent to the description, utilization and management of such forest land as the director may require for purposes of spray project and management program planning.

The date for submission of the information required under subsection 2, paragraph C, may be extended by the director upon a showing that such information is not then available.

Cutting plans accompanying the application may be utilized by the Bureau of Forestry for planning purposes, and may be shared with other government agencies, but shall not constitute records available for public inspection or disclosure pursuant to Title 1, section 408.

For excise tax purposes, such application must designate one person who shall be billed and notified of any lien recorded under this subchapter. When a tax bill or notice of lien is sent to this person, it shall constitute notice to all other landowners listed on the application. Each forest landowner shall be jointly and severally liable for any tax, penalty or interest imposed under this subchapter.

3. Effect of application. The director shall accept, not later than December 1st of each year, any application which to his satisfaction meets the requirements of this section any additional criteria which the director may impose by regulation in furtherance of the legislative policies of this subchapter. By December 31st, the director shall certify in writing to the State Tax Assessor the complete list of all participants in the program. The list shall include the names of the forest landowners, the names and addresses of the persons designated to be billed and served with notices of liens, particularized descriptions of the real estate included in the spray program area and statements of the acreage included in each parcel. If a change in ownership occurs after December 31st, the director shall inform the State Tax Assessor not later than the following September 1st.

Upon the director's acceptance of any such application, the forest land involved shall be eligible for inclusion within the spray project, and shall be subject to taxation pursuant to section 8427, regardless of any change in ownership of that forest land.

4. Spray project designation. Spray projects shall be designated in the following manner.

A. The director, acting in accordance with this subchapter, shall have ultimate and final discretion to determine, and from time to time modify, the location, type and manner of any spray project within the spray program area, subject to such regulatory review and approval by other state and federal agencies as is provided by law. The director shall make these determinations based upon evidence of the extent of budworm hazard to forest lands within the spray program area, forest stand composition, wood supply needs, buffer policies, opportunities for silvicultural and other management alternatives, the cost-effectiveness and biological soundness of spray treatment for particular forest lands, the recommendations of affected forest land owners and the public, environmental and public health concerns and such other factors as the director may deem to be in futherance of the legislative policies of this subchapter.

B. The director shall, not later than December 15th of each year, make a preliminary determination of the forest lands within the spray program area to which he tentatively deems it necessary and appropriate to apply chemical or biological spray treatment in the following year. Within 15 days

following such preliminary determination, the director shall furnish and make available to the affected forest land owners and to the public maps showing the forest lands preliminarily so designated. Notice of the preliminary designation shall be published in the state paper and such other newspapers as the director deems appropriate. The notice shall indicate where spray area maps will be available for inspection and where further information may be obtained, and shall provide information concerning withdrawal procedures.

C. Any forest land within the spray program area may be withdrawn from any annual spray project provided that a written request, adequately specifying on maps prescribed by the director the location of the acres to be withdrawn, is submitted by the forest land owner to the director no later than February 1st of the calendar year of the spray project involved. The director may at his discretion receive and act upon later-submitted requests for withdrawal.

5. General conditions for applications and requests. In addition to any other requirements for applications for spray project eligibility or for spray treatment and requests for withdrawal established under this subchapter, such applications and requests shall conform with the following requirements.

A. They shall be accompanied by maps, depicting the forest land involved, of the same size and scale as those accepted by the State Tax Assessor in the administration of the Tree Growth Tax Law.

B. They shall include a statement of ownership rights in the forest lands involved.

C. Subject to the provisions of paragraph D, they shall include written authorization from each owner of, or claimant to, an interest in the forest land involved, other than owners of easements and mortgages.

D. In the case of applications or requests affecting parcels of forest land held in common and undivided or joint ownership, a controlling or majority interest in the parcel shall have the power to make applications and requests under this sub-chapter and such applications and requests, as well as the decisions of the director thereon, shall be binding on all owners of interests in those lands.

E. Within 30 days following the transfer of any interest, other than an easement or mortgage, in any forest lands which are part of the spray program area, written notice of the transfer shall be sent to the director.

6. Settlement corridors. Settlement corridors are subject to the following provisions.

A. All land within 2 miles of publicly maintained roads shall be designated by the director as settlement corridors.

B. Land within settlement corridors shall not receive insecticide spray treatment except under the following circumstances:

(1) The land is in the spray program area;

(2) The landowner makes a written request for the treatment not later than January 15th in the calendar year of the spray project involved;

(3) The request is accompanied by such information as the director may require and meets such criteria as the director may adopt in furtherance of the legislative policies of this subchapter; and

(4) The request does not relate to land within a settlement corridor located in a municipality which has taken action to prohibit spray projects within that corridor pursuant to section 8425, subsection 2.

C. The provision for settlement corridors under this section does not impair or affect the director's authority to define and carry out other policies and procedures, including, without limitation, the use of no-spray buffers, designed to protect the public health and the environment, as he deems necessary or appropriate.

7. Technical assistance programs. The Bureau of Forestry shall undertake to develop and implement budworm management technical assistance programs for small wood lot owners.

8. Supply-demand analysis. The Bureau of Forestry shall conduct or cause to be conducted an analysis of future supply and demand for the spruce and fir resources of the State. The purpose of such analysis shall be to determine the types and levels of future spruce budworm protection needs and strategies for such spruce and fir resources.

9. Environmental health monitoring. The Bureau of Forestry shall cause to be conducted by an agency other than the Department of Conservation an environmental health monitoring program each year in which a spray project is conducted. The Bureau of Forestry shall prepare and submit an annual report to the Legislature dealing with all aspects of the environmental health monitoring conducted during the previous calendar year.

Section 8425. Regulatory Jurisdiction

1. General rule. The Bureau of Forestry, in undertaking any spray project, shall apply for and obtain any permits and approvals of the Maine Pesticide Control Board and the Maine Department of Agriculture, as required by the laws administered by those agencies. Except as provided in this section, spray projects may be conducted without adherence to the laws administered by other state agencies or by any municipal, county or other local government body.

Section 8427. Taxation

1. Generally. Forest land owners within the spray program area shall be subject to the excise taxes authorized under this section for the privilege of owning such lands and of receiving the benefits of spray project eligibility. In cases of divided ownership of such lands, the persons owning or claiming timber rights shall be subject to such taxes.

2. Pre-project excise tax. Forest land owners within the spray program area shall be subject to the pre-project excise tax at the rate established by the Legislature pursuant to section 8426, subsection 2. The tax shall be assessed and billed by the State Tax Assessor within 30 days following that legislative authorization.

3. Post-project excise tax. The post-project excise tax for all land owners within the spray program area shall be computed and assessed as follows.

A. The director shall determine the total amount of costs incurred or budgeted to be expended in connection with any spray project conducted during the then current calendar year.

B. The amount computed in paragraph A shall be reduced by the amount of any moneys received for that project from the Government of the United States.

C. The amount computed under paragraph B shall be divided by the number of acres which actually received spray treatment, as determined by the director, and that per acre allocation shall constitute the post-project spray tax rate.

D. By September 1st of each year, the director shall certify in writing to the State Tax Assessor the post-project spray tax rate, together with the number of acres within each ownership which actually received spray treatment.

E. The State Tax Assessor shall compute, assess and bill, by November 1st of each year, the amount of post-project excise taxes payable by each landowner within the spray program area, based upon:

(1) The product of the number of acres owned which actually received spray treatment times the post-project spray tax rate; less

(2) The amount assessed upon that owner on account of the pre-project excise tax for that calendar year.

In the event that the sum so calculated results in a negative balance for any landowner, the State Tax Assessor shall credit the amount of that balance against the next pre-project excise tax owed by that landowner; provided that if the landowner's participation in the program ceases, he shall receive the amount of that balance in the form of a rebate.

2. Municipal action. Any municipality may prohibit the execution of spray projects within settlement corridors, as designated pursuant to section 8424, subsection 6, which lie within the municipality. Any such prohibition, or the repeal thereof, may be enacted in accordance with the procedures for enactment before April 1st of any calendar year in which it shall apply and that the municipality shall send a certified copy of its enactment to the director within 10 days following the adoption of the same. Settlement corridors within which spray projects have been prohibited pursuant to this subsection shall thereupon be removed by the director from the spray program area.

Section 8426. Funding

1. Recommendation of the director. On or before January 1st of each year, the director shall report in writing to the Bureau of the Budget and to the Legislature his estimate of the costs of implementation of any spray project proposed for that calendar year.

2. Authorization by Legislature. Following the recommendation made in accordance with subsection 1, the Legislature shall determine, not later than February 15th the amount, if any, authorized for expenditure for any spray project in that calendar year and shall determine the pre-project excise tax rate, applicable to all acres within the spray program area, necessary to finance the full amount so authorized. That excise tax shall be assessed and collected in accordance with section 8427, subsection 2.

3. Spray project special accounts. Special accounts shall be established in the following manner.

A. The Treasurer of State shall establish 2 dedicated revenue accounts as follows.

(1) Into one account shall be deposited any revenues received by the State from the Government of the United States for any spray project.

(2) Into the other account shall be deposited any revenues received by the State from the excise taxes authorized pursuant to this subchapter.

B. The moneys credited to such accounts shall be used by the Bureau of Forestry to pay any expenses, debts, accounts and lawful demands incurred in connection with spray projects authorized under this subchapter, and the director shall authorize the State Controller to draw his warrant therefor at any time. Any remaining balance in these accounts shall continue from year to year as a fund available for the purposes set out in this subchapter and for no other purpose.

4. Borrowing from General Fund. To accomplish the purpose of this subchapter, the director, subject to the approval of the Governor, may borrow moneys from the General Fund for up to 120 days, at no interest, in order to enable the bureau to pay expenses, debts, accounts and lawful demands for any spray project authorized under subsection 2; provided that the aggregate amount of such borrowing may at no time exceed the amount of uncollected excise taxes authorized under this subchapter for that spray project.

4. Due date. The pre-project excise tax is due April 30th of the year in which it is assessed. The post-project excise tax is due December 15th of the year in which it is assessed. Notice of the amount of any tax due under this subchapter shall be presumed complete upon mailing of a bill therefor.

5. Interest and penalty. Any tax assessed under this subchapter which is not paid when due shall accrue interest at the rate of 1 1/2% for each month, of fraction thereof, that the tax remains unpaid; and a penalty equal to 20% of the unpaid tax shall be added to the liability of any person who fails to pay a tax when due.

6. Tax Lien. There shall be a tax lien to secure the payment of all taxes, penalties and interest assessed under this subchapter. The lien shall attach to all real estate described in any application made under section 8424, subsection 2, and shall take precedence over all other claims on that real estate and shall continue in force until the taxes, penalties and interest are paid or until the lien is otherwise terminated.

For purposes of lien foreclosure, unpaid taxes assessed under this subchapter shall be delinquent on the date due. Thereafter, the State Tax Assessor may record, in the registry of deeds of the county or registry district where that real estate lies, a certificate signed by the State Tax Assessor setting forth the name of the person designated in section 8424, subsection 2, the amount of unpaid taxes, penalties and interest and a description of the real estate subject to the lien. Not later than one week after recording the lien, the State Tax Assessor shall notify the person designated in section 8424, subsection 2, that a lien has been recorded. If the full amount of the tax, penalty and interest is not paid within 6 months of the recording, the lien shall be foreclosed. Upon foreclosure, the State shall become fee simple owner of the real estate free of all encumbrances. That real estate shall be inventoried as provided in Title 36, section 1283.

7. Review of assessments, supplemental assessments. Any forest landowner aggrieved by an assessment made under this subchapter may petition the State Tax Assessor for reconsideration, pursuant to Title 36, section 151, provided that the petition is filed within 45 days of the date of assessment. If justice requires, the State Tax Assessor may, with the approval of the Governor, abate, within 3 years from the date of assessment, all or part of any tax assessed under this subchapter by the State Tax Assessor.

Within 3 years of an assessment made under this subchapter, the State Tax Assessor may make a supplemental assessment if he finds that any previous assessment is imperfect or incomplete in any material aspect. An assessment may be made at any time with respect to a time period for which a fraudulent application has been filed.

The State Tax Assessor may require the assistance of the director in the performance of his duties under this subsection. The director shall recommend to the State Tax Assessor an appropriate disposition of any matter brought under this subsection. That recommendation shall be made within 15 days of the request and shall be in writing.

8. Collection by Attorney General. Whenever any person fails to pay any tax, interest and penalty due under this subchapter within the time provided, the Attorney General shall enforce payment by civil action against the person from whom it is due for the amount of the tax, interest and penalty, together with costs, in either the Superior or District Court in Kennebec County or in the judicial division in which that person has a residence or established place of business.

Section 8428. Duties and authority of the Director of the Bureau of Forestry.

1. General. The director shall supervise and coordinate the activities of bureau personnel in connection with all management programs.

2. Rules. From time to time the director may adopt and amend rules for the implementation of this subchapter. The rules shall be adopted in accordance with the procedures set forth in Title 5, chapter 375, subchapter II.

3. Applications. The director shall consider applications and requests made pursuant to section 8424, and shall grant conditionally or deny any such applications or requests.

4. Declaration of termination of spray projects. Upon receipt of information satisfactory to him to the effect that future spray projects will not be beneficial, cost-effective or otherwise in furtherance of the legislative policies of this subchapter, the director shall report the same to the Commissioner of Conservation and to the Governor and shall report the same to the Commissioner of Conservation and to the Governor and shall recommend to the Legislature that this subchapter be repealed or amended as appropriate.

5. Entry and inspection of lands. The director or his representatives may enter, upon reasonable advance notice to the landowner, at any reasonable time and in a reasonable manner, any tract of land for which application pursuant to section 8424, subsection 2, has been made in order to inspect the same free of any charge or cost imposed by the owner or his agents.

6. Inspection of records. The director or his representatives may likewise inspect the books and records of any applicant under section 8424, subsection 2, with respect to any information submitted in connection with that application. He also may require periodic progress reports from such persons in connection with any such information.

7. Contractual authority. The director, with the approval of the commissioner, shall have the authority to enter into contracts for the acquisition of insecticides, aircraft, personnel and other goods and services necessary or appropriate for management programs and for other purposes related to this subchapter.

8. Reimbursement to state agencies. Out of funds available for any spray project, the director, subject to the approval of the Governor, may reimburse other state agencies for costs incurred by them in connection with such spray project. Such costs may include,

but shall not be limited to those incurred for environmental and health monitoring and regulation. Any department or agency of State Government is authorized to accept funds which may be available for carrying out the purposes of this subchapter.

Section 8429. Forest insect manager

1. Position created. There is established within the Bureau of Forestry the position of Forest Insect Manager, which shall be funded by the General Fund. This position is not subject to the Personnel Law. The manager shall be appointed by the director with the approval of the Commissioner of Conservation and may be removed by the director with the approval of the commissioner. The manager shall be directly responsible for the development, coordination and implementation of management programs.

2. Cooperation. The manager shall consult and cooperate with the United States Forest Service, other agencies of the United States and of any state, the federal government of Canada, the governments of any provinces of Canada and public and private landowners in Maine in developing and undertaking joint management program activities.

3. Report. The manager shall, at the end of each calendar year, undertake a complete financial review of any management program activities undertaken that year and shall make a full report thereon to the next session of the Legislature. The report shall include, but not be limited to, sources of funding, private, state or federal and total expenditures broken down in the following categories: insecticides, aircraft, monitoring, research and other appropriate categories. Also to be included shall be a statement of any remaining balance by source, private, state or federal.

4. Permit applications. The manager shall be responsible for processing all applications for regulatory permits and approvals for spray project operations as required by this subchapter.

Section 8430. Research

1. Authority. The Bureau of Forestry, acting through its director, with the approval of the commissioner, may make grants of funds and enter into contracts for purposes of research related to forest management strategies, insecticide and spray application technologies, integrated pest management techniques, forest product marketing and utilization and other issues pertinent to the purposes of this subchapter. This research may be funded with other than excise tax moneys, provided that the cost of environmental and health monitoring of spray projects shall be part of annual spray project costs and not paid out of General Fund moneys.

2. Research on public lands. The commissioner, director or other chief executive officer of any state agency having jurisdiction over any public land may make that land available on such terms and conditions as he deems reasonable to any public or private nonprofit entity engaged in spruce budworm control research and related silvicultural control research. The Forest Insect Manager shall likewise encourage private landowners within the State to make their lands available for the same purposes.

APPENDIX J

SUMMARY OF RESULTS FROM AERIAL APPLICATION OF BACILLUS THURINGIENSIS (DIPEL 4L® AND THURICIDE 16B®), AGAINST THE SPRUCE BUDWORM ON THE MAINE 1980 BT DEMONSTRATION PROJECT.

Prepared by Imants Millers, Portsmouth Field Office, USDA Forest Service.

In 1980 a large-scale Bt demonstration project was carried out against the spruce budworm in Maine. The Maine Bureau of Forestry was responsible for the overall administration of the project. The Northeastern Area, State and Private Forestry, USDA Forest Service, provided financial assistance and was primarily responsible for the evaluation of foliage protection and spruce budworm population control. Three formulations of Bt were successfully applied in 5 widely separated areas, totalling about 200,000 acres (Appendix J Figure 1). The Bt was applied with 6 large helicopters, Bell 205's and 212's, equipped with standard booms and flat-spray nozzles with 8006 orifices. All the areas were to receive 8 BIU's of Bt per acre applied once. Dipel 4L, diluted with water (2 parts of Dipel 4L to 3 parts of water) was applied at 80 fl oz/acre (5.84 l/ha) in three areas: Moosehead, Caribou, and Houlton. Thuricide 16B, diluted with water (4 parts of Thuricide 16B to 1 part of water) was applied at 80 fl oz/acre (5.84 l/ha) in two areas: Haynesville and Washington County. Thuricide 16B diluted with water (1 part Thuricide 16B to 1 part of water) was applied at 128 fl oz/acre (9.35 l/ha) in two areas: Haynesville and Houlton.

Foliage Protection

The best foliage protection was obtained in the Caribou area, an average of 40.0 percent, with Dipel 4L (Appendix J Figure 2). However, the same formulation gave only moderate foliage protection (average 23.2 percent) in Houlton area and practically no protection (average 3.2 percent) in the Moosehead area.

Thuricide 16B applied at 5.84 l/ha in the Haynesville and Washington County areas gave 28.4 percent and 13.7 percent foliage protection, respectively. Thuricide 16B applied at the higher rate, 9.35 l/ha in the Haynesville and Houlton areas gave 30.3 percent and 16.5 percent foliage protection, respectively.

Comparisons between formulations were possible where they were used in the same area. In the Houlton area, Dipel 4L at 5.84 l/ha gave an average of 23.2 percent foliage protection and Thuricide 16B at 9.35 l/ha gave an average of 16.5 percent foliage protection, but statistically the difference was not significant ($t = 0.8463$). In the Haynesville area, Thuricide 16B at 9.35 l/ha gave an average of 30.3 percent foliage protection, while the same product at 5.84 l/ha gave an average of 28.4 percent foliage protection. Again, statistically the difference was not significant ($t = 0.3236$).

Overall for the project, in the areas where Dipel 4L at 5.84 l/ha was used an average of 27 percent foliage protection was achieved. Thuricide 16B at 9.35 l/ha gave an average of 24 percent, and the 5.84 l/ha rate gave an average of 17 percent foliage protection. Because of the high variation within treatments, statistically the differences between treatments are not significant.

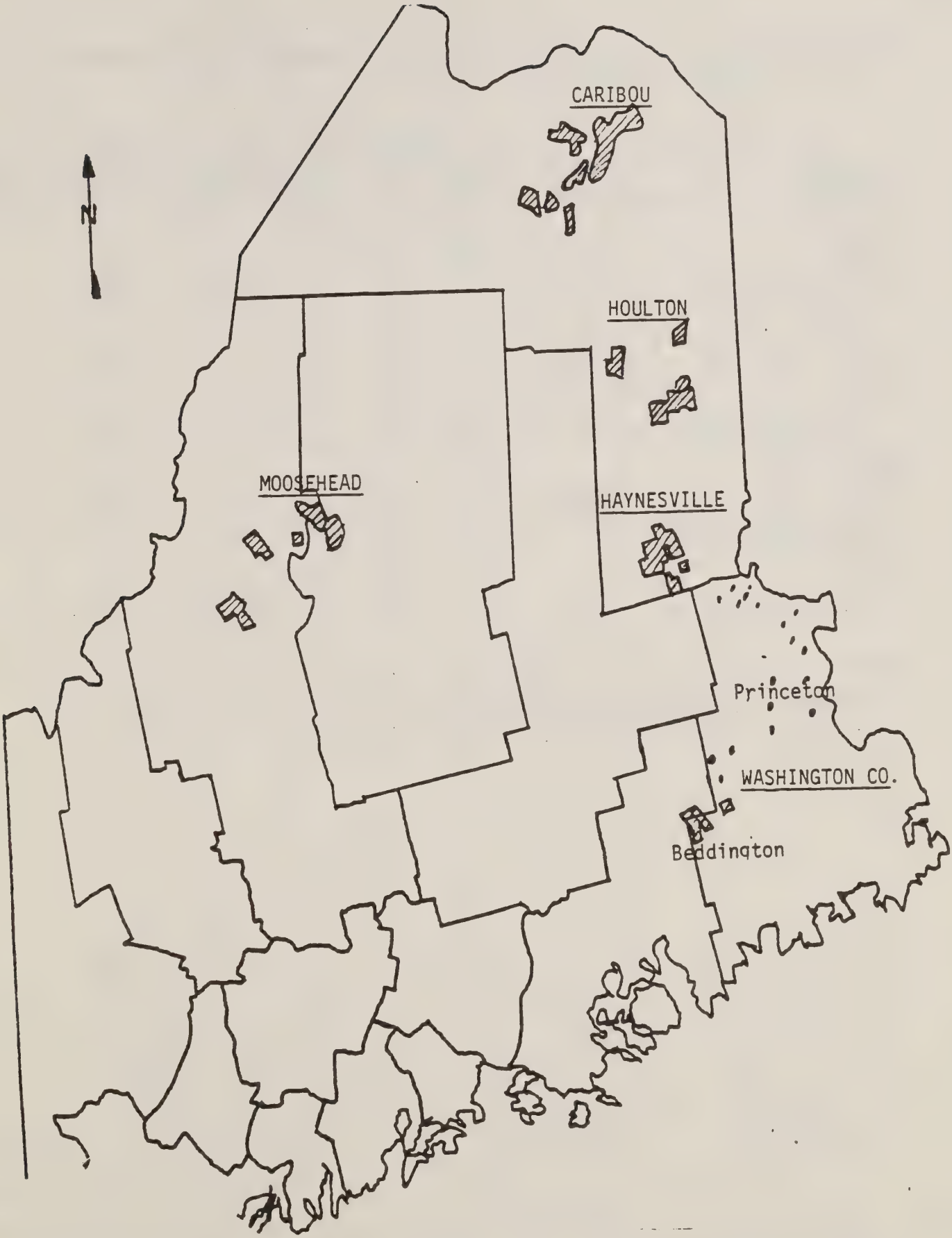
These results are based on data obtained from samples collected in spray blocks where treatments were applied according to prescribed plans. Data from 2 blocks were deleted where poorly mixed Thuricide was applied at unknown BIU rates. Also, data from four blocks were deleted because of reported precipitation within an hour after spraying.

Foliage protection, as used here, is defined as the difference between actual observed defoliation and that which was expected to occur if no spray had been applied. Because several areas had lower prespray larval populations in the checks than in the spray areas direct comparisons between checks and sprayed areas are not possible. A statewide regression was developed from the averages of 19 check blocks to predict defoliation from prespray larval population counts (Intercept = 33% defoliation; slope = 0.2%; r^2 = 0.7579). Foliage protection estimates were compared in two areas with equal check and spray area population densities using a locally derived regression and the statewide regression. The mean differences of foliage protection estimates between the local and statewide regressions were not statistically significant.

Larval Population Reduction

Estimates of spruce budworm population reductions were based on comparisons between a prespray survey, about 4th instar larvae, and a pupal survey (Appendix J Table 1.). The best results were obtained in the Caribou area. After adjustment for natural mortality using Abbott's (1925) method, Bt caused mortality in the Caribou area is estimated at 81 percent. The lowest adjusted mortality, an average of 22 percent, occurred in the Moosehead area treated with Dipel 4L.

The surviving population in the spray blocks averaged between 1.8 and 3.8 budworms per branch. In the checks, an average of 4.0 to 7.3 budworms per branch survived.



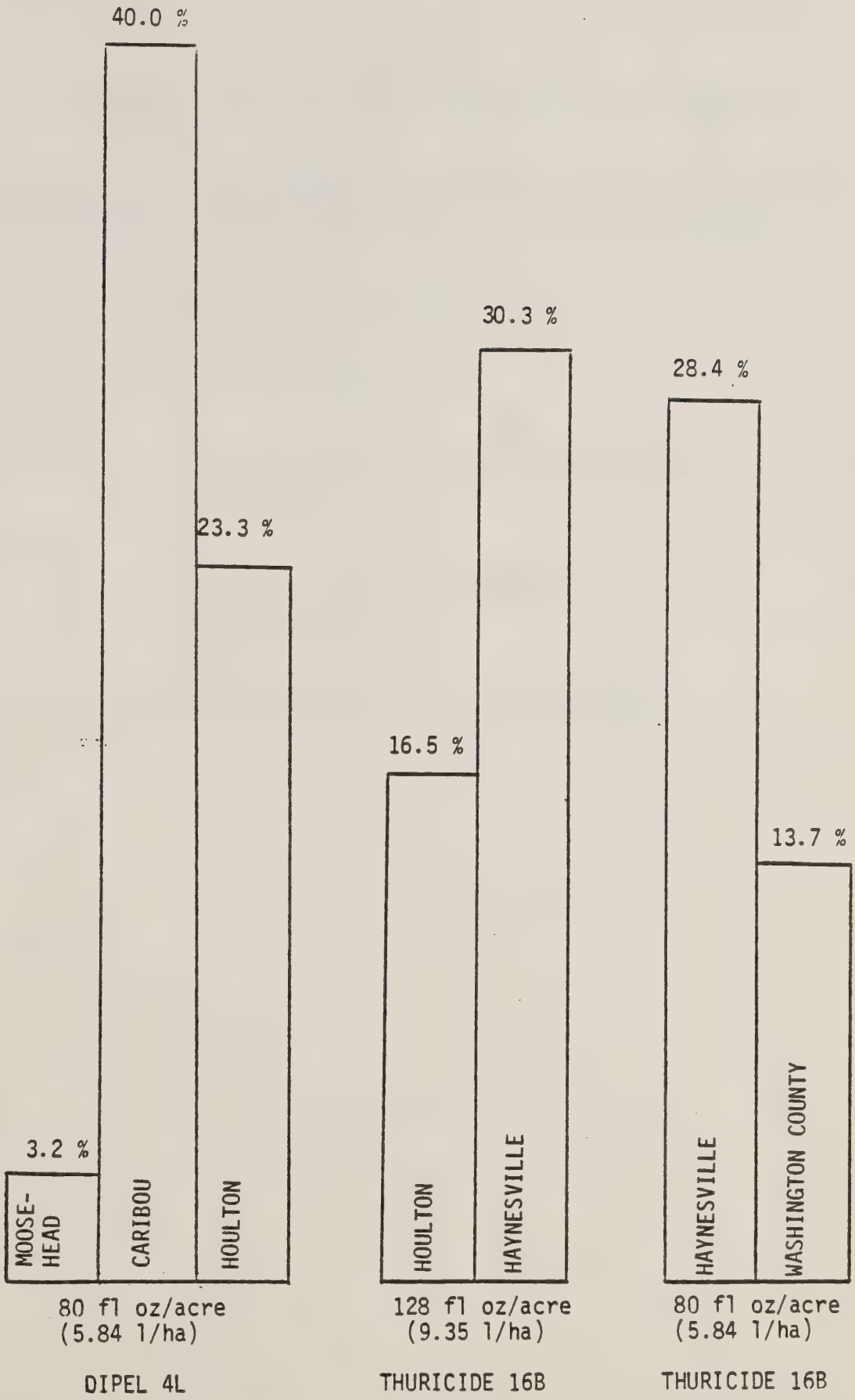
Appendix J Figure 1. Treatment areas and spray blocks on the Maine 1980 Bt Demonstration Project (spray blocks are crosshatched or dotted).

Appendix J Table 1. Spruce budworm population changes during Bt Demonstration Project in Maine 1980.

Area and treatment	No. sample clusters	No. budworm Per branch Prespray Mean	Prespray SD	Postspray Mean	Postspray SD	Budworm mortality[2] Unadjusted %	Adjusted %
Caribou							
Check [1]	10	19.8	14.3	7.3	4.6	63	--
Dipel 5.84 l/ha	40	31.2	23.3	2.2	2.3	93	81
Moosehead							
Check	30	28.4	11.8	5.1	2.6	82	--
Dipel 5.84 l/ha	20	26.8	13.8	3.8	3.4	86	22
Houlton							
Check	30	11.9	10.7	4.0	3.9	67	--
Dipel 5.84 l/ha	20	11.8	7.3	1.8	1.7	85	54
Thuricide 9.35 l/ha	19	23.1	15.6	2.5	2.1	89	68
Haynesville							
Check	38	18.3	10.5	5.9	3.3	68	--
Thuricide 9.35 l/ha	19	17.1	4.8	3.0	2.8	82	45
Thuricide 5.84 l/ha	20	18.8	7.7	3.5	2.4	81	42
Washington Co.							
Check	23	19.7	15.0	4.3	2.8	78	--
Thuricide 5.84 l/ha	50	31.7	15.3	3.2	2.9	90	55

1/ $\frac{\text{Percent alive in check - Percent alive in sprayed}}{\text{Percent alive in check}} \times 100$ (Abbott 1925)

2/ 5.84 l/ha = 80 fl oz/acre; 9.35 l/ha = 1 gal/acre



Appendix J Figure 2. Foliage protection achieved in 5 areas and with 3 formulations of Bt on the Maine 1980 Bt Demonstration Project.

APPENDIX K

AVAILABILITY OF PAST ENVIRONMENTAL IMPACT STATEMENTS

Past Draft and Final Environmental Impact Statements for Cooperative Spruce Budworm Suppression Projects in Maine are available for examination at the following locations.

Department of Conservation
Bureau of Forestry
Harlow Building
State House Station 22
Augusta, ME 04333

USDA-Forest Service
Northeastern Area, State & Private Forestry
370 Reed Road
Broomall, PA 19008

USDA-Forest Service
Northeastern Area, State & Private Forestry
Federal Building
Portsmouth, NH 03801

Draft and Final Environmental Statements available for examination are for the years 1978 through 1980.

APPENDIX L

HAZARD RATING SYSTEM USED TO PREDICT LOSSES IN SPRUCE BUDWORM INFESTED AREAS

Current Defoliation

Category	Values	Hazard Values
Trace	0-5 %	0
Light	6-20%	1
Moderate	21-50%	2
Heavy	51-80%	4
Severe	81+ %	6

Previous Defoliation
(1979 plus 1978)

Trace	0-9 %	0
Light	10-49 %	3
Moderate	50-129%	6
Heavy-Severe	130+ %	9
Dead Tops		+3

Egg Mass Deposit
Based on No. /100 sq ft of foliage

None	0	0
Light	1-99	1
Moderate	100-239	2
High	240-399	3
Very High	400-999	4
Extreme	1000+	5

Tree Vigor

Good	0
Fair	1
Poor	2
Very Poor (No chance of recovery)	3

Hazard

Hazard Rating	Range of Total Values
Low	0-6
Moderate	7-15
High	16-23
Extreme	24-26

Source: Maine Bureau of Forestry

APPENDIX M

COMMENTS ON THE DRAFT PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT AND THE USDA FOREST SERVICE RESPONSE

A total of 829 copies of the Draft Programmatic Environmental Impact Statement (DPEIS) were distributed to agencies, organizations, and interested individuals. A total of 38 comment letters were received during the 60-day public review period. These letters are reproduced in this appendix.

Major issues and concerns identified from comment letters and the USDA Forest Service response in the Final Programmatic Environmental Impact Statement (FPEIS) are shown below.

1. Size Of Area To Be Protected With Insecticides

   a) Several reviewers were concerned about the adequacy of the area to be protected with insecticides under the preferred alternative 5-year program. Their views included the following: (1) The size of the area to be protected with insecticides over the 5 years under the preferred alternative would be inadequate, (2) The size of the area to be protected should not be specified until further supply-demand data becomes available, (3) A decision to protect only 3 million acres would be irreversible, (4) The entire spruce-fir resource of Maine should be protected, or (5) The size of the area to be protected should be based on biological need alone.

      No new data were presented by these reviewers which would support a change in the size of area to be protected. Should a decision be made to participate in a 5-year program, the USDA Forest Service would, at a future date, examine the results of the supply-demand analysis now being planned by the Maine Bureau of Forestry and the results of the re-survey of Maine's forest resource now underway. After examining these data a decision would be made on whether a revision in the size of the area protected is needed.

   b) One reviewer commented that no explanation of the process used to decide on the size of the area to be protected over a 5-year program was given.

      The following explanation was added to the FPEIS:

      A decision to consider protection of 5 million acres under alternative 1 was based on the historical level of insecticide use under currently existing hazard conditions. From 1976 to 1980 an average of 1.9 million acres were treated annually with insecticides, with annual treatments ranging from 921,000 acres to 3,500,000 acres.

A decision to consider protection on about 3 million acres under alternatives 2 and 3 was based: (1) on limitations caused by recent extensive withdrawals of lands from protection by landowners under the provisions of State law, motivated at least in part by increasing protection costs, and (2) on tentative supply projections indicating a need to protect a minimum of 3 million acres in the long term.

A decision to consider protection of only 1 million acres under alternative 4 was based on several considerations: (1) a need to compare effects of programs using chemicals and biologicals with a program using only biologicals; (2) the relatively high cost of Bt, and (3) possible reluctance by landowners to use Bt on a large scale since they would pay the largest share of application costs.

c) Some reviewers expressed the view that acreage to be treated annually with chemical or biological insecticides should not have been specified or limited in the DPEIS, but rather should have been allowed to vary as needed based on biological need alone.

As indicated in the FPEIS the acreage to be treated is an anticipated average. Hence, acreage could vary from year to year over the 5 years, based on biological need. The average acreage specified in the selected alternative would allow treatment each year of an average of about 37 percent (950,000 acres, or 32 percent, with chemicals, plus 150,000 acres, or 5 percent, with Bt) of the protected area of 3 million acres. Insecticides have in the past provided adequate protection if applied each year to an average of about one-third to one-half of the area under protection.

d) One reviewer commented that any assumption that most of the spruce-fir will be food for spruce budworm is not true, that many places in Maine do not have any budworm, and that many have survived repeated attack with minimal damage.

As noted in the DPEIS only about 5 million acres out of Maine's 8 million acres of spuce-fir type are in high or extreme hazard condition. The DPEIS assumed loss of less than one-half of the average spruce-fir volume on acres in high or extreme hazard condition. Mortality is expected to vary in unprotected areas, allowing landowners to schedule harvest in areas where mortality is greatest.

Selection of areas to be treated with insecticides would be based on biological evaluation, with highest hazard areas receiving priority for protection each year. Tree condition is considered in hazard evaluation. The hazard rating system that would be used was added to the FPEIS.

2. Bt Use

a) Several reviewers expressed concern that Bt is not ready or is too expensive for use on the scale indicated for the preferred alternative 5-year program. Some reviewers suggested further testing before resuming operational use of Bt. Bt use in Maine has increased each year for the past 3 years: 1978-21,000 acres; 1979-41,000 acres; and 1980-200,000 acres. The use of Bt at the scale anticipated in the selected alternative program appears justifiable given the history of increased Bt use in Maine, and the results of the 1980 Bt demonstration which indicated enough foliage protection to prevent tree mortality was achieved in several areas. In at least one area where Bt did not provide satisfactory results in 1980, carbaryl was also applied and failed to provide satisfactory results. Use of Bt at the scale anticipated, along with continued operational improvements and thorough evaluation, including comparison of its effectiveness with that of chemicals under operational conditions appears justified. The proposed increase in the use of Bt would be dependent upon improved efficacy of operational treatments. The proposed increase would be re-evaluated each year based on efficacy in previous years and potential for further application improvements. The selected alternative would provide for increased use of Bt to permit protection of additional spruce-fir stands near environmentally sensitive areas. Increased use of Bt would also allow a decrease in use of chemical insecticides near environmentally sensitive areas. In our judgement, these advantages outweigh the cost associated with increased use of Bt. A discussion similar to that above was added in the FPEIS.

b) Several reviewers expressed a preference for Bt over chemicals, and one reviewer suggested Bt should not be judged by the same standards as chemicals.

No change was made in the FPEIS. As reflected in the rationale for the selected alternative in the FPEIS, the USDA Forest Service encourages use of Bt. Use of Bt on the scale anticipated under the selected alternative is responsive to these reviewers' comments.

c) One reviewer speculated about whether Bt might in the long term be more effective than chemicals since Bt does not affect natural enemies of spruce budworm and questioned whether Bt has been given a "fair test" compared to chemicals.

A study has not been done to determine whether this situation could occur in spruce budworm infested stands treated with Bt. The Maine Bureau of Forestry is initiating an evaluation of areas treated with Bt in previous years to determine if Bt may provide some protection the second year after treatment. If long term protection is apparent, follow-up studies would be needed to determine the reason.

d) One reviewer proposed that Bt be used in areas that cannot be treated with chemical insecticides, particularly buffers.

Under the selected alternative program Bt would be used in some of these areas. This was discussed in the DPEIS. No change was made in the FPEIS.

3. Implications For Landowners

a) One reviewer pointed out that the DPEIS did not identify a program to assist the non-industrial landowner with protection, since the non-industrial landowner can less easily pay for protection than the industrial landowner. Another reviewer suggested additional Federal assistance be provided to small, non-industrial landowners, noting that most of these owners have been forced to withdraw their lands from protection because of the high cost associated with the State's budworm excise tax policy. A third reviewer suggested that additional thought be given to a program for landowners within no-spray protection areas and settlement regions. One industry reviewer has a cooperative forestry program which provides management advice to the small private landowner. Another reviewer expressed a view that the State's Woodlot Management Program has not been adequate in the past.

Any non-industrial landowners whose lands are protected with insecticides would benefit from Federal funds provided for insecticide application under the selected alternative in the FPEIS. The extent to which these landowners benefit would depend on whether the State includes the landowners in a protection program and how the State chooses to distribute the cost-share funds among landownership categories. However, under State law the excise taxes raised to support insecticide protection are levied at the same rate for industrial as for non-industrial landowners, so in effect Federal funds benefit both landowner categories to the extent both request and receive insecticide protection. This feature of State legislation could prevent any special Federal financial assistance from reaching only non-industrial landowners. State general fund support for insecticide protection has been minimal which places an additional burden on landowners, both industrial and non-industrial.

Smaller non-industrial landowners, in addition to being affected by cost, may also be excluded from protection because small tracts are difficult to spray. Small tracts are usually not protected, even if the landowner may request protection, unless the small tract can be combined or included in a larger area designated for spraying.

At this time, the USDA Forest Service is not considering any financial assistance aimed specifically at helping the non-industrial landowner with protection costs. No changes were made in the FPEIS.

The USDA Forest Service is providing $174,000 in FY 1981 to help the Maine Bureau of Forestry increase the scope of the Budworm Woodlot Management Program. This Program provides technical assistance to small non-industrial landowners whose lands are not protected with insecticides. Assistance is provided in identifying and marketing budworm threatened stands. This Program was mentioned in the DPEIS.

b) One reviewer suggested that the DPEIS somehow might eliminate or seriously restrict the non-industrial landowner's ability to protect, and warned of far-reaching effects. Another reviewer cautioned that without commitments of protection after 5 years the small non-industrial landowner would be hit hardest due to an oversupply of dead wood for available markets, and that many such landowners would be forced to sell their land.

No data were provided by these reviewers and no changes were made in the FPEIS. The assumption of the second reviewer that protection will stop after 5 years appears weak in view of State legislation mandating the Maine Bureau of Forestry to carry out a protection program. This program would take place with or without Federal financial assistance.

c) One reviewer noted that the DPEIS did not provide the location of areas that would and would not be protected under the 5-year program. This reviewer assumed that only the "back country" would be protected leaving "Maine's most valuable forests, due to their easy access by good road systems and their close proximity to the mill, the labor force, and the market, to be written off to presalvage and salvage. This segregation will put the landowners at a disadvantage in managing their spruce-fir forest". A second reviewer commented that an explanation is needed as to how protected versus unprotected areas would be designated and how this would affect various landowners.

As was noted in the DPEIS areas to be protected would be designated by the Maine Bureau of Forestry in cooperation with landowners. The Maine Bureau of Forestry would use criteria similar to those used in the past in selecting areas for protection. Economic, biological, and environmental factors would be considered. Some additional information was included in the FPEIS on procedures to be followed in selection of areas for protection.

4. Procedures For Applying Chemical Insecticides Including Buffers

a) One reviewer suggested public awareness and close communications continue to be maintained with those persons in the area of a program. Another reviewer commented that the Maine Bureau

of Forestry should sponsor informational meetings on its spruce budworm management program. This reviewer expressed a view that such meetings held throughout the affected regions of Maine would better ensure general public support for a program.

Public information and education procedures planned for insecticide applications were added in the FPEIS. Both reviewers appeared to be concerned with an overall program, not just insecticide portions of a program. The Maine Bureau of Forestry will consider these reviewers' comments in planning public information efforts as part of the proposed 5-year management program.

b) One reviewer suggested careful planning in location of insecticide tanks at airports to avoid a safety hazard and comply with Federal regulations. The reviewer offered to provide assistance and asked to be informed of insecticide tank location plans.

On previous projects the Maine Bureau of Forestry has considered this concern far in advance of the spray operation and plans to continue to follow this practice.

c) Several reviewers were concerned about insecticide buffers: (1) One reviewer expressed support for buffer widths described in the DPEIS, (2) One reviewer expressed concern that buffer widths for small aircraft and helicopters around areas of human habitation may be too wide, remove many acres from protection, are inconsistent with buffers used in other projects elsewhere, and affect waterway shorelines as trees along shorelines are killed by spruce budworm, (3) One reviewer indicated no basis for buffers has been given, (4) One reviewer indicated that buffers and other precautions are not adequate to protect streams and ponds from contamination, (5) One reviewer indicated that precautions used in 1980 resulted in a more responsible project and commented that the buffers should continue to be used, (6) One reviewer commented that precautions to be taken are insufficient, and buffers don't prevent contamination of sensitive areas, and (7) One reviewer commented on the significance of steps taken in 1980 with regard to precautions including buffers, and encouraged use of 1980 buffers as future guidance in planning spray operations.

Procedures to be followed by the Maine Bureau of Forestry to protect environmentally sensitive areas are included in the FPEIS.

The buffers planned for permanent human habitation respond to public concerns over the use of insecticides for spruce budworm suppression in Maine. The available scientific reports concerning human health risks do not contain evidence

that buffers of the width considered are necessary. However, some sacrifice of resource near permanent human habitation is considered necessary in view of public concerns.

The buffers used around water respond to concern about effects on non-target organisms and contamination of water. Studies done over the past 2 years indicate that buffers have reduced water contamination. The results of these studies are discussed in the FPEIS. Some continued resource sacrifice along streams is considered justified in view of these concerns and demonstrated effectiveness of buffers.

As acknowledged in the FPEIS, the precautions are intended to minimize insecticide contamination of sensitive non-target areas, and would not totally eliminate all traces of insecticide spray drift from these areas.

No changes were made in buffers in response to the reviewers' comments. Additional information was included in the FPEIS on public notification and information procedures, aircraft control, and other project administration procedures.

d) Some reviewers commented that persons should not be contaminated with insecticides against their will, or be subjected to "chemical trespass".

Precautions planned by the Maine Bureau of Forestry would minimize insecticide contamination of non-target areas. While the precautions would not totally eliminate all traces of insecticide drift from non-target areas, the remoteness of most spray blocks would further reduce levels of exposure. Persons would be advised of potential exposure before entering spray blocks. Radio advisories and other information efforts would notify persons in the vicinity of spray blocks of up-coming spray activities. As noted in the FPEIS, available data indicate that persons who wish to avoid direct exposure can do so by staying indoors during nearby spray applications.

e) One reviewer offered a reminder that waters in which Atlantic salmon are found and hatchery water supplies should be considered under the critical fisheries designation in planning spray applications.

A definition of critical fisheries was added to the glossary in the FPEIS. The waters with which the reviewer is concerned are included. The Maine Bureau of Forestry will consider these waters in planning insecticide applications.

f) At least two reviewers were concerned about accidental direct off-target insecticide application in areas of human habitation.

The Maine Bureau of Forestry will continue to enhance training and spray aircraft control procedures. A description of some of the procedures to be followed was added to the FPEIS.

g) One reviewer suggested a definitive survey of insecticide drift.

Studies conducted in 1979 and 1980 give some insight into drift. The results of these studies were added in the FPEIS.

h) One reviewer was concerned about insecticide contamination of organic farms. The reviewer indicated that many potential organic producers will not bother to apply for certification if they are within 25 miles of a spray block. The reviewer also asked the basis for a statement that only one or two organic farms in the Spruce-Fir Protection District could potentially be contaminated.

The reviewer's comment regarding certification of organic farms appears to be in error. Buffers are not mentioned in the Certification Standards of the Maine Organic Farmer and Gardener Association. The Association does, however, support the concept and use of buffers in insecticide applications. Certification could be revoked if a farm were directly sprayed (personal communication, Rob Johnson).

As was noted in the DPEIS, there are only two certified organic farms in the Spruce-Fir Protection District. The statement referred to by the reviewer applied to these two farms, and was not changed. The Maine Bureau of Forestry buffers these farms and also, if requested by the owners, other organic farms near spruce budworm spray areas.

i) Two reviewers asked about the meaning of "no unconsented, uninformed exposure" in regard to carbaryl use.

The health advisory panel's statement and recommendations on this matter were included in the DPEIS. As applied by the Maine Bureau of Forestry "no unconsented, uninformed exposure" means that persons are advised before entering spray blocks of possible exposure to direct application of carbaryl, and are asked to express their consent before entering. Because of this Maine Bureau of Forestry policy, carbaryl is applied only in areas where access roads can be controlled either by establishing gates or roadblocks.

5. Commitments To Apply Silvicultural Methods

a) Some forest industry reviewers expressed strong commitment to silvicultural methods. These reviewers also pointed out a need for insecticide use while silvicultural methods are

implemented and until a continuous supply of wood can be assured. At least two of these reviewers presented data on silvicultural accomplishments.

No changes were made in the FPEIS. The commitments and accomplishments in carrying out silvicultural methods reported by these reviewers would help ensure success of an IPM program. As was discussed in the DPEIS, application of an IPM program would require cooperation between the State and private forest landowners, and silvicultural and utilization-marketing portions of IPM would be largely the responsibility of landowners.

b) Some reviewers questioned whether landowners are committed to carrying out silvicultural methods. At least two reviewers were concerned because the DPEIS did not require guarantees that certain silvicultural practices would be followed, or provide incentives tied to Federal assistance.

After October 1981, under a new State law, the Maine Bureau of Forestry will request from each landowner a 5-year cutting plan and other management plans and information as a requirement for participation in a spray program. This provision in the State law was mentioned in the DPEIS. How this authority will be used and whether commitments to silvicultural methods will be required has not yet been determined by the Maine Bureau of Forestry. As noted in the FPEIS, the selected 5-year program would provide additional incentive and time for landowners and mill owners to further apply and assess silvicultural and utilization-marketing methods. This additional time would help landowners maintain their spruce-fir inventories over this period.

c) One reviewer objected to having targets for specific silvicultural methods in the DPEIS, and indicated that the same silvicultural objectives could be reached by different methods. At least two reviewers encouraged recognition of a need for flexibility in choice of control methods.

The data in the DPEIS were provided by the Maine Bureau of Forestry based on a survey of large landowners. Such data provides a measure of anticipated accomplishment statewide. As recognized in the DPEIS, application of silvicultural methods is largely the responsibility of private landowners and use of these methods is expected to vary widely, depending on landowner objectives and constraints. The word target was removed in the FPEIS, but no other change was made.

d) One reviewer took exception to a statement in the DPEIS that a long term insecticide protection program could result in landowner reluctance to invest in silvicultural and utilization-marketing methods. This reviewer cited the interdependence between insecticide protection and the other methods. Another reviewer commented that the same statement in the DPEIS was accurate.

The statement was re-worded in the FPEIS to indicate that possible overdependence on insecticide protection could lead to reluctance by some landowners to invest in silvicultural and utilization-marketing methods. We see this as a possibilty.

e) One reviewer noted that the DPEIS did not contain a commitment to minimize effects such as dust, siltation and soil displacement associated with timber harvesting.

Few additional impacts are expected as a result of increased use of silvicultural methods under the preferred alternative. Impacts associated with current harvesting and other silvicultural operations may continue. These operations are subject in part to regulation by the State Land Use Regulation Commission which considers matters such as proximity of cutting to streams. No change was made in the FPEIS.

6. Effectiveness Of Silvicultural Methods

a) One reviewer offered the observation that removal of fir during silvicultural operations might not lessen the potential for outbreaks since outbreaks can start without fir.

This reviewer's comment was added to the FPEIS. In addition, the assumption in the DPEIS that stands with less fir will incur less damage was changed to - will suffer less tree mortality during an outbreak.

b) Two reviewers indicated that the spruce budworm problem might be managed by silviculture alone, without spraying. One reviewer asked how valid it is to assume that insecticide use is needed to avoid disruption of silvicultural and utilization-marketing methods. Other reviewers pointed out that silviculture is a long term solution and that use of insecticides is a necessity.

As noted in the DPEIS, because of the large area of Maine's spruce-fir type, relatively little of the spruce-fir forest can be treated silviculturally in any one year. For this reason silvicultural methods could not substantially alter the course of the current outbreak. Any significant effect on present spruce budworm populations would be in local areas where budworm host trees had been removed.

7. Feasibility Of Salvaging Trees In Unprotected Areas

a) Two reviewers questioned whether trees in unprotected areas could be salvaged in the period of time discussed under the preferred alternative program.

Under the preferred alternative all harvest would be on unprotected areas for the 5 years of the program. As indicated in the benefit-cost analysis, mortality on

unprotected areas would not accumulate to 20 percent of average per acre volume for 7 to 8 years. Given the current rate of spruce-fir harvest it appears that most threatened trees could be harvested before they are killed and most of the dead trees could be salvaged if landowners adjusted their cutting plans to harvest only in unprotected areas. Additional considerations are that some unprotected acreage may not be available for harvest due to such factors as landowner unwillingness to sell timber, and inaccessibility. Also, fir volumes are not the same in all areas, and mortality is not likely to be the same in all areas. This would allow targeting of harvesting operations to areas where risk of loss is the greatest. No changes were made in the FPEIS.

b) One reviewer questioned whether landowners could justify development of markets for additional spruce budworm killed trees that may be harvested from unprotected areas since these trees would be available for only a relatively short time.

A similar comment was added to the FPEIS. It reads as follows: Some landowners and mill owners may have difficulty justifying development of markets and facilities for handling any additional budworm killed timber since that timber would be available for only a relatively short period of time.

8. Effectiveness Of Chemical Insecticide Protection

a) One reviewer indicated that the preferred alternative stated that high volume fir stands should receive maximum protection to fill an expected supply shortfall, and indicated that there is some question about whether such stands will survive 20 to 30 years even with protection.

The preferred alternative only called for some removal of stands of lowest fir content or lowest value from protection. However, the reviewer's concern suggests some care should be used to select fir stands for protection that are in the best condition, and likely to be accessible for harvest should their condition worsen. As was discussed in the DPEIS 21 to 30 years would be needed to harvest only one-half of the mature fir volume at the 1978 rate of harvest, and nearly 100 years would be required to harvest 90 percent of this volume. This situation indicates a strong possibility that much of the existing spruce-fir volume could die of old age before harvest. This again suggests the limitations of protection and the need to exercise care in selection of areas to protect. No change was made in the FPEIS.

b) At least one reviewer stated and several others implied that they support use of chemical insecticides.

No change was necessary in the FPEIS.

9. Environmental Effects Of Chemical Insecticides

a) One reviewer commented that the DPEIS did not consider direct human exposure to carbaryl.

This subject was considered in the DPEIS. No change was made in the FPEIS.

b) One reviewer felt that viral enhancement should be thoroughly studied before a 5-year program is considered.

Precautions proposed for carbaryl application consider a health advisory panel's recommendations concerning the viral enhancement issue. If in the future new recommendations are made, the USDA Forest Service would examine the recommendations in any annual environmental assessment. No change was made in the PEIS.

c) Several reviewers were concerned about inadequacy of information in the DPEIS, or lack of information available, on insecticide effects on populations of non-target organisms such as bees, stoneflies, and earthworms. Some of these reviewers were concerned about long term effects of chemical application on populations of non-target insects. One reviewer was concerned with the lack of information in the DPEIS on effects on crayfish populations. One reviewer was concerned with possible effects on marine organisms.

Additional discussion was included in the FPEIS on possible effects on marine and fresh water crustaceans and mollusks. Further consideration was also given to the possible effects of repeated aerial application on populations of non-target organisms.

d) One reviewer expressed concern about the effect of carbaryl that might reach coastal public water supplies.

The information reviewed in the DPEIS indicates that the probability of significant concentrations of carbaryl reaching coastal public water supplies is very low. No change was made in the FPEIS.

e) One reviewer was concerned that on the basis of the health advisory panel's statement on "no uninformed or unconsented exposure" and the inevitability of drift, carbaryl should not be applied in Maine.

In the panel's letter in Appendix B of the DPEIS, it is apparently recognized that some exposure would occur due to drift to non-target areas. The panel pointed out the importance of maximizing buffer zones and limiting drift. No change was made in the FPEIS.

f) One reviewer was concerned with a possible build up of resistance to chemicals in Maine budworm populations.

It is true that resistance can build up in any population of insects treated repeatedly with chemicals. However, the situation in Maine is one in which resistance should not build up. An explanation of the reasoning behind this conclusion was added in the FPEIS.

g) Two reviewers were concerned with the effect of spraying on the ability of parasites and predators to control budworm populations.

Spraying can affect parasite and predator populations. However, data on the effects of spraying on parasites and predators indicate that spraying has little effect on the ability of parasites and predators to control epidemic spruce budworm populations. Also in situations where no chemicals have been used against the budworm (the Lake States and areas of Canada) parasites and predators have not provided effective control of spruce budworm outbreaks. A prime example may be the last outbreak in Maine. At that time the major contributing factor to control of the outbreak was spruce-fir mortality. A discussion of this subject was added in the FPEIS.

h) One reviewer was concerned that a statement regarding drift in the DPEIS from a study of human exposure to carbaryl during the 1978 Maine Spruce Budworm Suppression Project was misleading. The reviewer noted that long range drift had been reported in another study.

The statement in the DPEIS was a direct quote and could not be changed. Elsewhere in the FPEIS, a change was made to include results of a 1979 study in which carbaryl was detected 12 miles from a spray block. However, the amount detected was far below one percent below the permissable time weighted average for occupational exposure to carbaryl. This same information was presented in the 1980 EIS.

i) One reviewer noted that the DPEIS contained very little mention of possible insecticide effects on aircraft pilots.

Results of recent studies on insecticide exposure of aircraft pilots in Maine were included in the DPEIS. No effects were noted although exposure did occur. The lack of effects was expected because the insecticides used have low mammalian

toxicity and are comparatively safe when used properly. Nevertheless, during insecticide applications, State public health officers would, as in the past, supervise the handling of insecticides. They routinely sample selected project personnel including pilots to determine the level of exposure to insecticides, and to detect any operational problems that need correction. Hospitals and doctors are notified of the spray operation so that they will be familiar with the insecticides used and, if required, be prepared to handle emergencies. Spray pilots and others wear protective clothing and equipment, including respirators where necessary, to prevent contact with insecticides in case of accidental spills or leakages. Spray pilots and other project personnel are advised of symptoms associated with the insecticides in use and of procedures to follow if any symptoms appear. Spray pilots are also supplied with atropine, the antidote for carbaryl, for use if symptoms appear. Spruce budworm suppression projects in Maine have had an excellent safety record. A discussion of these procedures was added in the FPEIS. Otherwise, no change was made.

j) Some reviewers expressed general concern about inadequacy of data available on such matters as: possible interaction between chemicals used for spruce budworm and chemicals used for other purposes, effects of breakdown products or interaction of breakdown products, possible impacts of carrying agents and emulsifiers, and possible combined effects of acid rain and chemical insecticides on aquatic organisms.

No change was made in the FPEIS except to add the names of some breakdown products. Summaries of reports concerning concentrations of chemical insecticides found in water, and on foliage and in soil for various periods after spraying, along with the effects of the insecticides on various components of the environment are presented in the DPEIS and FPEIS. Environmental studies, for example, of the effect of Sevin 4 Oil on aquatic insects measure the impact not only of the active ingredient, but also its breakdown products, carriers, and emulsifiers in the formulation. As noted by some of the reviewers, answers to some of the more complex questions, e.g. effects of acid rain and chemical insecticides together on aquatic organisms, are not available. Researchers in Maine are beginning to consider this concern.

k) At least three reviewers expressed support or made suggestions for monitoring studies of the effects of chemical insecticides.

A list of the environmental monitoring studies being considered by the Maine Bureau of Forestry for 1981 was added in the FPEIS. A portion of Federal funds provided for any insecticide application under the selected alternative would be used to carry out environmental monitoring activities administered by the State.

l) At least eight reviewers expressed general dissatisfaction with the possible use of chemical insecticides.

The dissatisfaction is not unexpected. As recognized in the DPEIS, the concern and dissatisfaction of some individuals and groups with chemical treatments could continue over the 5 year program. A 1979 opinion poll cited in the DPEIS indicated little public support for chemical insecticides as the chief means of protection whereas a majority were favorable toward an IPM approach. Based on this poll and a similar poll taken in 1980, an IPM program which involves some use of chemicals would apparently be supported by a majority. In any case, as was noted in the DPEIS, demonstrated progress in implementing IPM over the 5-year program would probably be essential to ensuring general public support. No change was necessary in the FPEIS.

m) One reviewer commented that recent field studies indicate that forest application of acephate may result in population reductions of several bird species by emigration as well as direct bird mortality, and that the avian hazard of acephate must be considered in program development.

Apparently, the reviewer was referring to studies discussed in the DPEIS. The reviewer offered no additional information. As indicated by studies referred to in the DPEIS, risk of bird mortality from acephate exposure is apparently very low. Much uncertainty exists about the cause of bird mortality in the two cases (in California and Florida) where it has been reported. No change was needed in the FPEIS.

n) Two reviewers expressed general concerns about possible use of Dylox.

No new data was offered by the reviewers, and no change was made in the FPEIS.

10. Need For Spruce Protection

Three reviewers expressed a need to consider spruce in protection, rather than only fir. Specific concerns were: while spruce may survive a short epidemic, it might not survive a long epidemic; the present condition of spruce is poor in some areas and there are indications of the beginning of some mortality, and that after fir is removed from spruce-fir stands, the threat of spruce mortality could increase the need for protection.

As noted in the DPEIS, consideration would be given to protection of stands with a high spruce component if spruce mortality is imminent and budworm populations are high. No change was needed in the FPEIS.

11. Forest Regulation

Some reviewers pointed out the importance they attach to a regulated forest and indicated the need to consider maintaining protection to bring about regulation or restructuring of age classes.

This issue was considered in the DPEIS. The selected alternative program should allow landowners to progress toward regulation. Whether regulation can be achieved in one, two, or several rotations is uncertain, and whether regulation would mean an end to the need for protection is unclear. Landowner management plans regarding regulation may vary and different landowners may have different timetables for achieving regulation. Regulation may not be a goal of all. No change was made in the FPEIS.

12. 5-Year Program Concept

a) Some reviewers expressed support for a 5-year program. However several of these reviewers objected to aspects of the preferred alternative.

No change was made in the FPEIS. Please see issues 1,2,7,13 and 14 for these reviewers' objections to aspects of the preferred alternative.

b) One reviewer supported long range planning but asked for clarification about what commitments are involved, particularly with regard to silvicultural practices.

As recognized in the DPEIS, application of silvicultural measures is largely the responsibility of landowners and use of these methods is expected to vary widely depending on landowner objectives and constraints. Several large landowners have plans to carry out these measures. This was noted in the DPEIS and additional information regarding these plans was added in the FPEIS.

c) One reviewer questioned the need for commitment to chemical use for 5 years indicating that such a step encourages widespread chemical use.

The use of chemical insecticides being considered under the selected alternative is significantly less than that used on the average over the past 5 years, and in our judgment does represent a marked reduction. No change was made in the FPEIS.

d) One reviewer asked why just a 5-year period was considered rather than a longer period, another reviewer felt that a longer program should have been considered.

A 5-year period was selected since over this period of time spruce budworm conditions and available technology are not likely to change greatly. At the end of 5 years the proposed program would be re-evaluated. If at any time during the 5 years substantive new information became available, a re-evaluation of the program under the NEPA process would be considered. This explanation was added in the FPEIS.

13. Federal Funding

a) Several reviewers viewed the preparation of the DPEIS and identification of a preferred alternative as representing a 5-year commitment by the USDA Forest Service to provide financial assistance for spruce budworm management in Maine. This view is in error. The alternative selected would only guide USDA Forest Service consideration of annual requests for financial assistance from the Maine Bureau of Forestry. The Maine Bureau of Forestry may request USDA Forest Service financial assistance for any aspect of the described preferred alternative program in any one year. The USDA Forest Service would maintain an independent responsibility for review of the State's request based on USDA Forest Service criteria of biological, environmental, and economic acceptability. Any decision concerning annual financial assistance would be made only after completion of an environmental assessment carried out in accordance with NEPA. In order to avoid duplication, the FPEIS would be referred to where possible. Any information not considered in the FPEIS would be reviewed. Discussion to clarify this matter was included in the FPEIS.

b) Several reviewers encouraged the USDA Forest Service to provide funds for Bt only, or to provide a higher cost share for Bt than for chemicals.

No change was made in the FPEIS. Cost share factors for operational control projects are set by USDA Forest Service national policy. This policy does not allow funding Bt application at a higher level than chemicals. Similarly, USDA Forest Service policy does not allow cost sharing for only Bt on an operational project using both Bt and other insecticides. Special projects like the 200,000 acre demonstration of Bt in Maine in 1980 are funded separately on a case by case basis.

c) Some reviewers were concerned that the assumption in the benefit-cost analysis that protection may be necessary for the next 26 years implied investment of public funds for the entire period.

Because of the long term nature of the spruce budworm problem and possible need for long term protection investments, the benefit-cost analysis is not limited to a 5-year

program. The sources of funds for the 5-year period or for later protection investments were not a consideration in the benefit-cost analysis. Only the amounts that may need to be invested annually were considered. An explanation clarifying this situation was added to the benefit-cost analysis.

d) Some reviewers were opposed to use of Federal funds in any amount or suggested use of public funds should be phased out, with costs being shifted to the product consumer. One reviewer suggested public funds be used only for silviculture.

The State could act to phase out Federal funding by annually requesting less funds than allowed for under USDA Forest Service cost sharing policy. No change was made in the FPEIS.

e) One reviewer suggested Federal funds should be used for research and monitoring of the impacts of chemical insecticides and development of alternative control methods. This reviewer also suggested that, if possible, alternative chemicals such as pheromones should be integrated into any program on an accelerated timetable. A second reviewer expressed support for efforts to monitor effects on water resources and water related lands. A third reviewer called for a more thorough environmental and human health protection and monitoring program. A fourth reviewer suggested that the proposed program should include monitoring to measure the impact of reduced populations of aquatic and terrestrial insects on fish and birds, and that monitoring of streams draining from spray blocks and aircraft staging areas be considered.

The CANUSA program is seeking to develop pheromones and insect growth regulators. The CANUSA program also has supported environmental monitoring studies. In addition, the USDA Forest Service through the Forest Pest Management Program of State and Private Forestry has funded environmental monitoring studies in Maine. A portion of Federal funds provided for any insecticide application under the selected alternative would be used to carry out environmental monitoring administered by the State. A list of environmental monitoring studies being considered in 1981 was added in the FPEIS.

f) One reviewer commented that the effects of "No-Subsidy" (Federal funds, we assume) was not given adequate treatment, indicating that there is "therefore little basis on which to judge whether a subsidy is justified or not."

The possible effects of no Federal financial assistance were discussed in the DPEIS. No change was made in the FPEIS.

g) One reviewer expressed a view that "gains to the public in general have been minimal for such an expenditure" referring to past use of Federal funds for insecticide application in Maine.

As indicated in the DPEIS gains to the public would occur to the extent that insecticide application provides for a more stable contribution of the spruce-fir industry to the economy of the State and Region through taxes, wages, and raw materials. The gains to the public from insecticide applications are not easy to quantify because of the many influences on the spruce-fir industry in addition to spruce budworm and insecticide protection. No change was made in the FPEIS.

14. Integrated Pest Management Concepts

a) Several reviewers expressed support for the IPM concept discussed in DPEIS, but many of these reviewers questioned the use of Bt on the scale envisioned.
No change was made in the FPEIS. See issue 2 for these reviewers' comments on Bt.

b) Two reviewers found the IPM concept to be misleading, since portions of IPM would have a very limited effect on today's situation.

No change was made in the FPEIS. The long term nature of some components of IPM such as silviculture was recognized in the DPEIS.

c) At least three reviewers expressed opinions that the IPM concepts discussed in the DPEIS represent business as usual, or no change from past practice. These reviewers were particularly concerned about possible continued chemical insecticide use on the scale envisioned in the preferred alternative.

This concern was expressed during the scoping phase of the environmental analysis. The use of chemical insecticides anticipated under the selected alternative is less than used on the average over the past 5 years, and does represent a marked reduction. This change was discussed in the DPEIS.

The use of chemical insecticides is recognized as an integral part of IPM. In the President's 1979 Message to Congress, IPM is described as "a systems approach to reduce pest damage to tolerable levels through a variety of techniques, including predators and parasites, genetically resistant hosts, natural environmental modifications, and when necessary and appropriate, chemical insecticides".

In many ways other aspects of an IPM program would be similar to past practices. This is to be expected since some aspects of silviculture, for example, have been used in the past, and are not likely to have a significant effect in the short term.

15. Preferred Alternative

a) Several reviewers expressed views on the choice of the preferred alternative:

(1) Four reviewers supported the choice of the preferred alternative (alternative 3).
(2) One reviewer agreed with the choice of the preferred alternative but expressed concern about the use of chemicals.
(3) One reviewer agreed with the choice of the preferred alternative but expressed hope that other alternatives would soon be available for use.
(4) One reviewer preferred alternative 4 and expressed hope that Bt use could be reduced with time.
(5) One reviewer preferred no action, but would support a purely silvicultural approach.
(6) One reviewer supported alternative 1.
(7) One reviewer commented that the preferred alternative is not justifiable given the information presented in the DPEIS.
(8) One reviewer would have preferred alternative 4, but supported the anticipated decrease in chemical insecticide use and increase in biological insecticide use with the preferred alternative.

These reviewers' comments were considered in identification of the selected alternative.

b) Several reviewers expressed disatisfaction with all of the alternatives, desiring instead "open-ended" insecticide use based primarily on biological need.

These reviewers' comments regarding their desire for "open-ended" insecticide use were considered under issue 1.

c) Some reviewers expressed concern that: the alternatives did not address "real IPM", that a wider range of alternatives was not considered, or that the first 3 alternatives were too similar. Most of the reviewers did not make specific suggestions. One reviewer suggested a wider range of acreages should have been considered but offered no specifics. One reviewer indicated a need to consider an alternative which would involve use of chemicals on about one-half the acreage considered under alternative 3.

Some of the historical trends that have served to limit the range of alternatives are: the continued lack of short term methods other than insecticides, the reduction in

the size of forest area that can be protected as buffers, landowner silvicultural withdrawals, targeted spraying, and refined spray block planning have increased, and the resulting increased concentration of protection activities on fewer acres. The alternatives were revised to better reflect these historical trends, and the reviewers' comments.

d) One reviewer was concerned that the preferred alternative program did not provide incentives for increasing research and development of new technology.

Decisions relating to research and development were not considered since the alternatives considered were formulated on the basis of existing technology in an attempt to address the problems of the next 5 years. In addition, the Federal government through the USDA Forest Service has a significant on-going research and development commitment to spruce budworm. An example is the Canada-United States Spruce Budworms Program (CANUSA). This Program was discussed in the DPEIS. Similarly, the Maine Bureau of Forestry administers a research program on budworm.

16. Need To Consider Effects Of Additional Insecticides

a) Several reviewers were concerned that environmental effects of some insecticides, particularly fenitrothion, were not considered in the DPEIS.

Effects of carbaryl, acephate, trichlorfon, and Bt were considered since these insecticides have been used in recent years. As indicated in the DPEIS, other registered insecticides may be considered for use during a 5-year program. These might include new insecticides or insecticides now registered, such as fenitrothion. The Maine Bureau of Forestry would be responsible for deciding which insecticides are used. The USDA Forest Service however would maintain an independent responsibility for reviewing the effects of any insecticide considered for use. Effects of fenitrothion have been examined in a previous environmental impact statement (Draft EIS, 1978). This document is available for public review at the locations given in Appendix K.

17. Evaluation Criteria

a) One reviewer suggested that the criterion to minimize potential for long term disruption of Maine's spruce-fir economy should be given greater weight than the other criteria.

To make this change would place economic considerations above other environmental considerations in the criteria. This suggestion was not incorporated in the FPEIS. Economic criteria should be given no greater weight than the other criteria in selecting an alternative.

b) One reviewer suggested including a criterion which considers the consequences of tree mortality on game habitat.

The possible effect of tree mortality on deer yards was considered in the DPEIS. The criterion which considers the level of tree mortality also considers this possible effect. No change was made in the FPEIS.

c) One reviewer suggested considering effects on tree growth in the evaluation criteria.

Since the primary objective of protection in Maine is to prevent tree mortality, not growth loss, this suggestion was not included. After completion of the re-survey of Maine's forest resource now underway, more information should be available on spruce-fir growth and inventory trends in Maine.

d) At least three reviewers expressed concern or asked about the basis for the criterion of holding fir mortality to 5 percent. One of the reviewers stated that 5 percent is unrealistically low and could not be met under any protection strategy. This criterion was re-worded in the PEIS. It now reads as follows: Minimizes spruce budworm caused balsam fir and spruce mortality. This wording parallels the wording of the other criteria.

18. Benefit-Cost Analysis

a) Two reviewers noted that the benefit-cost analysis did not consider environmental or health costs.

No monetary losses have been associated with environmental effects on populations of non-target invertebrates, and no human health effects have been noted from previous suppression projects in Maine. This explanation was added to the FPEIS. Benefit-cost analysis procedure does not provide for consideration of "costs" that cannot be assigned monetary values.

b) At least one reviewer was concerned that growth losses were not considered in the benefit-cost analysis.

Growth losses were not considered because the primary objective of protection in Maine is to prevent tree mortality, not growth loss. Only potential mortality losses with and without protection are used to calculate benefits. The reviewer offered data on growth reduction in unprotected areas. Reliable growth data from protected areas is not available. This explanation was added in the FPEIS.

c) Some reviewers' comments indicated a need to explain why an investment period of more than 5 years was considered in the benefit-cost analysis since only a 5-year program was being considered.

Because of the long term nature of the spruce budworm problem and possible need for long term protection investments, the benefit-cost analysis is not limited to a 5-year program. The sources of funds, either for the 5-year period or for later protection investments were not a consideration in the benefit-cost analysis. Only the amounts that may need to be invested annually were considered. An explanation clarifying this situation was added in the benefit-cost analysis.

d) One reviewer noted that the benefit-cost analysis failed to recognize or consider value added in manufacturing.

Benefit-cost analysis procedure does not allow consideration of secondary benefits such as value added. An estimate of value added in manufacture associated with Maine's spruce-fir resource was in the DPEIS. The explanation was added to the benefit-cost analysis in the FPEIS.

e) One reviewer noted that no consideration was given to the fact that the benefits of spraying are much less if spraying is stopped at some time in the future before the outbreak ends.

This was discussed in the DPEIS. No change was made in the FPEIS.

f) One reviewer expressed concern that data on stand conditions, and data on non-type areas being sprayed are not available for use in benefit-cost analysis.

We share the reviewer's concern, and would like to have this data to refine assumptions in the benefit-cost analysis. Data indicating an increase in tree mortality or that a lesser or greater volume of spruce-fir per acre is being protected would modify the benefit-cost analysis assumptions. At present assumptions are that protection is effective in preventing tree mortality and that protection is being provided to 17 cords per acre of spruce-fir, an average for the entire State from the 1970 Forest Survey. No change was made in the FPEIS.

g) One reviewer was concerned that consideration was not given to year round program administration costs, costs that occur if tourists choose not to come to Maine because of spraying, or costs to organic farms that cannot be certified because they are near areas sprayed.

Most state program administration costs are included in the data on spray costs and most other such costs would occur whether insecticides are used or not. Environmental impact studies and security measures associated with insecticide application were considered. No data is available on any effect on tourism or organic farms, so these factors were not considered. No changes were made in the FPEIS.

h) One reviewer indicated concern that the benefit-cost analysis, did not consider how much of the benefit is distributed to Canada, and how this would affect the benefit-cost results.

Who benefits is not a consideration in benefit-cost analysis, i.e.,procedures for benefit-cost analysis do not provide for consideration of distribution of benefits. Therefore, no adjustment in the benefit-cost analysis results was made. Use of protected wood in Canada may indirectly be of benefit to the United States. The benefit to the Canadian economy was discussed in one part of the DPEIS. Some discussion of this matter was added in the benefit-cost analysis.

i) One reviewer felt that a greater volume of trees per acre would be protected than assumed in the benefit-cost analysis.

The reviewer offered volume estimates but no indication of the source or soundness of the data. No change was made in the FPEIS.

j) One reviewer was concerned that the harvest rates assumed were too high.

The benefit-cost analysis assumed that harvested volumes will remain steady in order to meet existing industrial demand. A statement has been added in the FPEIS which explains that assumptions about harvest plans used in the analysis are tentative. Discussion of the new authority that the State will have in October 1981 to request information on cutting plans from landowners was also added to the benefit-cost analysis.

k) One reviewer noted that there was no discussion of the effects of proposed use of Federal funds on cost and benefits, no discussion of who benefits and no discussion of where money spent on spraying goes.

Source of funds is not a consideration in benefit-cost analysis. Similarly, who benefits is not a consideration. Only the total amount of funds is considered. As stated in the DPEIS, the Federal cost share in insecticide treatment would be 36 percent. Some discussion of distribution of benefits was added to the FPEIS. The benefit-cost analysis contains a breakdown of insecticide treatment costs in 1980.

19. Level Of Cut

At least one reviewer was concerned that the DPEIS did not consider that increased spruce-fir milling capacity may have created a need for more insecticide protection and that the DPEIS did not discuss how to obtain a sustainable timber economy. Another reviewer was concerned that level of cut was viewed as a constant in the DPEIS.

Discussion of increased production capacity has been added to the FPEIS. The production capacity of Maine's forest products industry which uses the spruce-fir resource has been expanding in recent years as reflected in the following data. Production capacity for Maine's paper mills rose from 2.8 million tons per year in 1975 to 3.4 million tons per year in 1980. Simultaneously, Maine's spruce-fir sawlog production increased from 138 million board feet in 1975 to 360 million board feet in 1979.

As was discussed in the DPEIS, export of spruce-fir sawlog volume to Canada decreased from 63 percent in 1975 to 47 percent in 1979. Thus the increase in milling capacity may be associated in part with decreased export rather than increased cut. Nevertheless the volume of spruce-fir sawtimber cut in Maine doubled from 1969 to 1979, as was noted in the DPEIS. During the same period volume of spruce-fir pulpwood cut remained almost the same due to the increased use of wood residues.

Although sawlog cut and production capacity have increased, protection needs may not have increased. It is possible that increased sawtimber cuts decrease immediate protection needs by cutting timber that otherwise would be protected. Another view is that if sawlog capacity had not increased, additional acres would be abandoned to budworm. In the long term it does appear that increased sawlog demand would increase protection needs, assuming no decrease in forest susceptibility or vulnerability to budworm.

Decisions and plans regarding future level of cut and production capacity are the responsibility of individual landowners and mill owners. Some information regarding future levels of cut will be requested by the Maine Bureau of Forestry after October 1981. The FPEIS considers only existing industrial demand and the level of cut needed to meet that demand.

A definitive discussion of how to obtain a sustainable timber economy is not included in the FPEIS. Although certain aspects of this issue such as forest regulation, including pesticide protection, were considered. This vast issue is beyond the scope of this analysis.

20. Employment

a) One reviewer asked how much increased employment to carry out silvicultural methods is likely to offset decreased employment associated with decreased use of chemical methods.

As noted in the DPEIS, increases in silvicultural employment are dependent on landowner investment in intensified practices and the extent of mechanization. On a short term basis more acres can be treated per dollar with insecticides than with silviculture. However, over the long term silvicultural investment may be more cost-effective than spraying. We encourage landowners to continue increasing their staffs responsible for forest management activities.

b) One reviewer was concerned that insecticides are being used as a substitute for labor, or that spraying could be eliminated by intensified management and increased employment.

To the extent that silviculture might reduce the need for spraying, this concern is justified. Over the long term silviculture may be effective as a substitute for spraying. However as was explained in the DPEIS, silviculture is not likely to have much effect in the short term because of the vast acreage of forest involved. Furthermore, the high cost of labor and the limitations of markets show the rate at which silviculture can be intensified.

c) One reviewer has indicated that "Maine people need jobs managing our forests for sustained yields that are optimum, not maximum...".

As indicated in the DPEIS, silviculture and utilization-marketing methods are the responsibility of individual landowners and mill owners. Decisions on employment levels and sustained yield levels are made by these landowners and mill owners. Questions of "optimum" sustained yields are beyond the scope of this analysis. No change was made in the FPEIS.

21. Liability

One reviewer asked whether the USDA Forest Service "can justify subsidizing a State program that shelters the sprayers [landowners] against liability for their actions", and asked for an expression of the USDA Forest Service position on this liability question. One reviewer expressed the view that "If the paper companies want to spray let them do it, as long as they are fully and strictly liable ....".

Under existing policy, the USDA Forest Service provides financial assistance for insect control projects on private land only if the projects are administered and coordinated by the State. The liability question is then between the State and private landowners. No change was made in the FPEIS.

22. Miscellaneous

a) One reviewer suggested that the FPEIS should contain specific information on insecticide plans for 1981, the current hazard map, and results of 1980 insecticide application.

These items are not seen as necessary in a document which considers a 5-year program. Specific plans would be considered in any subsequent environmental assessment, should Federal funds be requested.

b) One reviewer asked whether consideration had been given to planting non-host species.

This was discussed in the DPEIS, and no change was made.

c) One reviewer asked that the discussion of opinion polls in the DPEIS be clarified, particularly in regard to whether respondents understood the extent to which chemicals would be used as a part of IPM.

The discussion was revised by adding the following sentence in the FPEIS: "Results also indicate a trend toward favoring a decrease in spraying." We are unable to clarify this further since the opinion poll is subjective to some extent.

d) One reviewer commented that alternatives 2 and 3 better satisfied the criterion on providing flexibility to meet changes, than alternative 1.

The reviewer assumed that alternative 1 would involve use of chemical methods only which was incorrect. No change was made in the FPEIS.

e) Two reviewers were concerned that not enough attention was given in the DPEIS to the effects of no action in the short and long term. One of these reviewers predicted a severe shortage of wood after 10 years without protection followed by 30 years of severe wood shortage with many forest industries going out of business.

A change was made in the FPEIS to indicate a supply shortfall could be expected in 10 to 20 years with no action.

Additional changes were made throughout the document to improve clarity, make technical corrections, update technical information, and strengthen analyses. Some of the changes respond to reviewers' comments. Others reflect refinements in Maine Bureau of Forestry plans and data. These changes include the following:

Additional information was included on precautions planned during insecticide application including buffers.

Benefit-cost calculations were revised using final insecticide cost data for 1980.

Results of 1980 environmental monitoring studies not available for the DPEIS were included.

Results of the 1980 Bt demonstration project were included.

The recent EPA action removing carbaryl from pre-RPAR status and restoring it to full registration was noted.

A statement in the DPEIS that the supply model developed by the Green Woods Project did not consider effects of spruce budworm on uneven-aged stands was in error. The statement was removed.

The hazard rating system that would be used in deciding protection needs and priorities was included.

Preliminary environmental monitoring plans for 1981 were included.

Several terms such as "critical fishery" and "regulation" were added to the glossary.

Additional explanation was added regarding the process by which annual requests for Federal financial assistance would be considered during a 5-year program. This included an explanation that environmental assessments will be prepared to consider annual requests by the State under the selected program.

All comment letters are included in this Appendix. Each comment letter is numbered in the upper right hand corner. For ease of reference a list of major issues together with the numbers of the comment letters associated with each issue is provided. Also, issues in each comment letter are identified by number. A check mark (✓) on a comment letter indicates that a suggested technical correction or change was made in the FPEIS.

To reduce bulk, four documents, submitted as a part of comment letter 19 and two reports submitted with comment letter 2 were not included in this Appendix. These documents are available for public review at the locations listed on page M-30. Reports on the 1980 Bt demonstration project attached to comment letters 14 and 21 were not included in this Appendix. However, this report was included in Appendix J.

One reviewer (comment letter No. 36) indicated that additional comments would be submitted later. No additional written comments were received. However, the reviewer did offer additional comments at the January 9, 1981 public hearing.

ISSUE	LETTER NUMBERS
1. Size of area to be protected with insecticides.	5, 14, 16, 20, 21, 22, 23, 26, 27, 30, 33
2. Bt Use.	12, 14, 16, 18, 21, 22, 23, 26, 28, 30, 31, 32, 33
3. Implications for landowners.	23, 26, 27, 30, 32, 33
4. Procedures for applying chemical insecticides including buffers.	6, 7, 12, 13, 14, 17, 18, 19, 20, 22, 27, 29, 35
5. Commitments to apply silvicultural methods.	5, 6, 16, 17, 18, 20, 21, 23, 26, 27, 32
6. Effectiveness of silvicultural methods.	4, 17, 27, 28
7. Feasibility of salvaging trees in unprotected areas.	14, 21, 26, 32
8. Effectiveness of chemical insecticide protection.	16, 22, 32
9. Environmental effects of chemical insecticides.	17, 19, 20, 24, 25, 27, 28, 29, 31, 34, 38
10. Need for spruce protection.	21, 22, 32
11. Forest regulation.	16, 26
12. 5-year program concept.	14, 20, 21, 22, 23, 26, 27, 29, 30, 33
13. Federal funding.	14, 18, 19, 20, 23, 24, 26, 27, 28, 29, 34, 38
14. IPM concept.	14, 16, 17, 24, 26, 27, 31, 32, 37
15. Preferred alternative.	5, 6, 12, 13, 14, 17, 18, 20 21, 25, 27, 29, 31, 34, 37
16. Need to consider effects of additional insecticides.	14, 15, 22, 26, 28, 30, 33
17. Evaluation criteria.	11, 16, 22, 27, 28
18. Benefit-cost analysis.	11, 17, 18, 20, 23, 26, 27
19. Level of cut and production capacity.	5, 17, 18
20. Employment	17, 24, 27
21. Liability	17, 24
22. Miscellaneous	26, 28, 30

PUBLIC HEARING

On January 9, 1981, a public hearing was held at Orono, Maine to receive new information from the public not received during the 60-day public comment period which ended December 10, 1980. The public hearing was formally requested by a Maine citizens group on December 22, 1980, twelve days after the close of the 60-day review period on the DPEIS. Notices of the hearing were sent to the news media in Maine on December 23, 1980.

Twelve persons spoke at the hearing. One of the speakers submitted written comments for an individual who was unable to be present at the hearing. Two other persons submitted written comments after the hearing. One person who spoke at the hearing had also commented on the 1980 Draft Environmental Impact Statement, and requested that those comments be reconsidered. A transcript of the hearing along with the written comments are available for public examination at the three locations listed below:

Department of Conservation
Bureau of Forestry
State Office Building
Augusta, ME 04333

USDA Forest Service
Northeastern Area, State & Private Forestry
370 Reed Road
Broomall, PA 19008

USDA Forest Service
Northeastern Area, State & Private Forestry
Federal Building
Portsmouth, NH 03801

Most of the issues and information presented at the hearing had also been brought up during the 60-day review period. These issues are briefly summarized below. For a more complete summary of these issues, and the USDA Forest Service response,the reader is referred to the first part of this Appendix.

(1) Some persons found the IPM concept in the DPEIS to be misleading because of the proposed continued use of chemical insecticides as a part of three of the alternatives. Some persons were concerned about possible overdependence on insecticides and lack of progress in silviculture. One person commented that use of chemical insecticides is necessary to keep trees alive while other longer term measures are applied.

(2) Some persons felt that the first three alternatives were too similar. At least one person felt that specific acreage estimates for insecticide use should not be given, allowing flexibility based on biological need.

(3) Some persons expressed concern about environmental effects of chemical insecticides, particularly fear of long term undetected effects in humans; concern about "unconsenting" exposure associated with drift, and concern about effects on non-target organisms including budworm parasites and predators.

(4) Some persons were concerned that landowners may not be committed to carrying out silvicultural practices outlined in the DPEIS or that enough attention was not given to silviculture as an alternative to insecticide use.

(5) Some persons were concerned about use of public funds and who would receive the benefits from the proposed 5-year program.

(6) Some persons felt more attention should be given to environmental impact studies of chemical insecticides, effects on human health, effects on the Maine environment, and effects on parasites and predators of the spruce budworm.

(7) Some persons expressed reservations about Bt use on the scale anticipated under the preferred alternative in view of its past performance. Others expressed support for Bt use or asked whether Bt might be as effective as, or more effective than, chemicals in the long term, and suggested long term evaluation.

(8) At least one person was concerned that the benefit-cost analysis indicates benefits from insecticide use are long term and contingent on insecticide use for as long as the outbreak continues or until the protected trees are cut. Similarly one reviewer was concerned that the "costs" of long term adverse environmental effects were not considered in the benefit-cost analysis, since the analysis is long term.

(9) Some reviewers expressed general support for the concept of a 5-year program, but questioned other aspects of the DPEIS. At least one person felt that a 5-year program would lend stability to forest management planning and provide incentive for more application of longer term aspects of IPM.

(10) Some persons expressed opinions that the DPEIS gave too much weight to economic as opposed to other environmental concerns. Some were concerned, for example, that long term adverse environmental effects were not given adequate consideration. Some were concerned that economic gains would be short term whereas environmental effects might continue for an extended period of time. Other persons spoke of the importance of the Maine spruce-fir economy and need for protection against the spruce budworm.

(11) Concern was expressed by some over the impacts of spruce budworm on small landowners.

Issues brought up during the hearing that had not been brought up during the 60-day review period included the following:

Bt Use

One person felt that Bt should be applied by fixed-wing aircraft rather than helicopters, and that this could be done at lesser cost with greater effectiveness.

As has been noted in the DPEIS, cost of Bt application might be less with fixed-wing aircraft than with large helicopters, however, many variables are involved. Helicopters offer advantages of more precise application, less ferry time to and from spray blocks and greater maneuverability. Efficacy with helicopters has been equal to or greater than efficacy with fixed-wing aircraft, both in forestry and agricultural programs. This has been documented in various reports. No change was made in the FPEIS.

Procedures for Applying Chemical Insecticides Including Buffers

One person suggested that spray aircraft should be inspected for airworthiness.

The Maine Bureau of Forestry plans to have the spray contractors' aircraft inspected for airworthiness.

One person commented that large transport aircraft used in spraying should be phased out and replaced by small agricultural-type aircraft since the latter offer the advantage of less drift.

As was noted in the DPEIS, drift is reduced with lower release height and consequently the use of smaller aircraft which fly at lower altitudes could reduce drift near sensitive areas. As also noted in the DPEIS, helicopters and small fixed-wing aircraft would be used as much as possible in spray applications. The trend has been toward these types of aircraft and this trend is expected to continue. No change was made in the FPEIS.

One person suggested that insecticide application should be done using low volumes rather than ultra low volumes and water as a carrier rather than oil in order to reduce drift.

Drift is independent of volume. In addition, drift may be as great with water as with oil-based formulations. Both chemical and Bt formulations are applied in Maine not at "ultra low volumes", but at low volume rates. No changes were necessary in the FPEIS.

One person felt that spray pilots do not have adequate time to become familiar with spray blocks before insecticide application.

Guides who lead spray aircraft fly spray blocks near environmentally sensitive areas prior to spraying to become familiar with block boundaries and sensitive areas. This information was added in the FPEIS.

One person felt that personnel employed by the State to monitor the spray operation are not qualified.

The Maine Bureau of Forestry plans to continue to enhance training and orientation of the contractors' guides and the States' monitors. Prior to a 1981 insecticide application, these persons would undergo a 2 week training program.

Environmental Effects of Chemical Insecticides

One person asked that the FPEIS recognize that carbaryl is readily absorbed through the skin. This person offered an estimate that 65 percent of the Sevin 4 Oil that reaches the skin is absorbed by the body.

We were unable to verify this reviewer's information. We did find the following quotation:

"Studies indicate that about 12 percent of the carbaryl coming into contact with the skin will be absorbed...". This quotation is from a letter of March 21, 1978 from A. E. Conroy II, Director of Pesticides and Toxic Substances, EPA, to Charles S. Hood, Chief, State Insect Pest Control, Massachusetts Department of Forests and Parks, Boston, MA. The 12 percent figure does not vary significantly from the figure in the DPEIS.

One person suggested that the DPEIS should have discussed ecological effects such as disruption of pollination rather than just describe effects on non-target organisms.

The DPEIS contained some discussion of ecological effects associated with reduction in populations of non-target invertebrates. Studies on these kinds of effects are just now being initiated in Maine and continued uncertainty exists. Some additional information on studies planned and underway was added to the FPEIS.

Preferred Alternative

One person questioned a statement in the DPEIS indicating that use of silviculture might decrease if Federal funds were not available for insecticide treatment. This person felt that silvicultural methods might increase without Federal funds.

Use of silvicultural methods to reduce susceptibility of future stands would probably not continue to increase since some landowners would probably not be able to afford the expense of both insecticide treatment and silvicultural methods. This statement is included in the FPEIS.

Some persons preferred no action and pointed out that if no action had been taken when the current outbreak began, the outbreak would by now have run its course and a new forest would be established.

This may be true but the new forest would be only 10 to 20 years old and whether sufficient merchantable timber would have been available during this interim period is uncertain. In addition, no progress would or could have been made toward reducing the future susceptibility of the forest. No change was made in the FPEIS.

Federal Funding

One person suggested that the role of the USDA Forest Service in "budworm projects" should be more clearly defined.

A statement regarding the Federal role in the proposed 5-year IPM program was added in the FPEIS.

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
MANCHESTER AREA OFFICE ~~XXXXXXXXXX~~ Service
NORRIS COTTON FEDERAL BUILDING
275 CHESTNUT STREET
MANCHESTER, NEW HAMPSHIRE 03103

REGION I

October 27, 1980

REPLY REFER TO:
1.3 (Sieminski)

Mr. Peter W. Orr
Forest Pest Management
Northeastern Area State and Private Forestry
370 Reed Road
Broomall, PA 19008

Dear Mr. Orr:

We have reviewed the Draft Programmatic Environmental Impact Statement for the Maine Spruce Budworm Management Project, USDA-FS-NA-81-01.

The alternatives discussed and related environmental impacts bear no direct relationship to HUD defined areas of jurisdiction or expertise.

Thank you for the opportunity to review these materials.

Sincerely,

Joseph P. Garaffa
Acting Supervisor

NOV 05 1980

(2)

Cooperative Fishery Research Unit

October 30, 1980

Mr. Peter W. Orr
Forest Pest Management
Northeastern Area State and Private Forestry
370 Reed Road
Broomall, PA 19008

Dear Mr. Orr:

I read the environmental part of the Draft EIS for budworm management and am pleased that it is so well written, balanced, and with few factual errors.

I have only a couple or minor comments.

1. Page 19 line 1: The two "trout" species listed are actually both members of the same species, namely Arctic charr. These are both isolated local populations of landlocked forms. A more accurate wording would be: "Two rare forms of the Arctic charr (Salvelinus alpinus), the blueback trout and Sunapee trout, are landlocked in a few lakes within the Maine Spruce . . ." ✔

2. Some of the citations of personal communications are now available as reports and some reports are now published. In Appendix A page 16 line 12: Joan Trial's report is now available. On A 24 much of Hydorn's report is now published (enclosed).

3. Enclosed is a copy of a paper now in press on disappearance constants of carbaryl from streams, that you might find useful.

Sincerely,

Jon G. Stanley
Unit Leader

JGS/njs

Enclosures

COOPERATORS

NOV 1 0 1980

DEPARTMENT OF
INLAND FISHERIES AND WILDLIFE
284 STATE STREET
AUGUSTA, MAINE 04333

GLENN H. MANUEL
Commissioner

J. WILLIAM PEPPARD
Deputy Commissioner

34 Idaho Ave.
Bangor, Maine 04401

November 3, 1980

Mr. Peter W. Orr
Forest Pest Management
Northeastern Area State
and Private Forestry
370 Reed Road
Broomall, Pennsylvania 19008

Dear Mr. Orr:

In accordance with your request, we have reviewed the following document: "Proposed Cooperative 5-year (1981-1985) Spruce Budworm Management Program for Maine, Draft Programmatic EIS, USDA-FS-NA-81-01."

We have only one specific correction to update the statement on Maine chars on page 19, paragraph 1. This statement should read as follows:

> "Two rare chars, the blueback and Sunapee, (Salvelinus alpinus) are found within the Maine Spruce-Fir Protection District. The blueback char is found in only 10 lakes and ponds, and the Sunapee char occurs naturally in only one pond and has been introduced in nine others." ✓

We appreciate the opportunity to review this document.

Sincerely yours,

Kendall Warner

Kendall Warner,
Senior Fishery Research
Biologist
Fishery Division

KW/jpn
cc: L. Bond
P. Andrews

(4)

UNIVERSITÉ LAVAL
FACULTÉ DE FORESTERIE ET DE GÉODÉSIE
CITÉ UNIVERSITAIRE
QUÉBEC CANADA
G1K 7P4

November 10, 1980

Mr. Peter W. Orr
Forest Pest Management
Northeastern Area State and
Private Forestry
370 Reed Road
Broomall, Penn. 19008
U.S.A.

Mr. Orr,

I would like to propose a few comments in view of the preparation of the Cooperative 5-year Spruce Budworm Management Program for Maine.

Among the 5 options that were discussed, the choice of the third is certainly valid since it brings together the making of a real IPM program. However, I have a few reservations regarding the silvicultural aspects of the program. Most of the prescriptions I read are based on the principle that balsam fir is the most susceptible host of the budworm. This statement is certainly true regarding the vulnerability of fir but far from being certain regarding susceptibility. Current research as well as past observations strongly suggest that white spruce and possibly red spruce are the prefered hosts of the budworm, particulary at the begining of an outbreak. On the other hand, in Ontario and Quebec, the outbreak begins in a forest zone where such species as white pine, hemlock, yellow birch and sugar maple are present, no doubt reflecting some climatic conditions favorable to the insect. Hence a certain caution should be exerted when considering the choice of silvicultural methods. Considering these observations and the fact that spruce are less vulnerable than fir I would make the following suggestions. 6

A- White pine, yellow birch or sugar maple or hemlock present.

Precommercial thinning: Yes
Shelterwood harvest: No
Planting of spruces: No

B- White pine, yellow birch or sugar maple or hemlock absent.

Precommercial thinning: Yes
Shelterwood harvest: Yes
Planting of spruces: Yes

Hoping that these remarks will be helpful, I remain,

YH/jl

Yvan Hardy

(5)

To: Allen J. Schacht

Subject: Comments on E.I.S. 5 year budworm project (Maine).

I have chosen alternative 5, no action for the following reasons.

(a) No major landowners have sincerely considered Silverculture as a means of controlling the budworm. Because it seems a popular way to continue public funding of the spray program they consent in word only not by deed. 5

(b) A shortfall of Spruce and Fir is eminent even with the spray program of 25+ years. The reasons are: a lack of Silverculture, T.S.I., properly trained woodsmen and short term economics by over expanding corporations. 19

(c) Labor should increase in the future as other species become competitive for energy, also putting the forest back into shape through timberstand improvements, planting programs and better cutting practices.

(d) The Maine Forest Service as a watchdog over spray programs tend to side with the major landowners. Until a few years ago the commissioners' salary was paid by the Pulp and Paper Industry. Programs that involve small landowners such as F.I.P. and A.C.P. have been reluctantly carried out.

(e) The United States Forest Service and the Maine Forest Service's assumption that most of all the Spruce and Fir will be food for the budworm is not true. Many places in Maine do not have any budworm, many have survived repeated attacks with minimal damage. 1

Millions for Silverculture but not one more penny for spray. 15

Sincerely,

Melvin Ames

Melvin Ames

P.S. I am a professional forester with
35 years experience, recently elected
County Commissioner of Maine's most
wooded county(Piscataquis).

RECEIVED
DIRECTOR, NA-S ? OF FOR
NOV 17 RECD
a. m. p. m.

DEC 03 1980

(6)

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Centers for Disease Control
Atlanta, Georgia 30333

December 1, 1980

Mr. Peter W. Orr
Forest Pest Management
Northeastern Area State
and Private Forestry
370 Reed Road
Broomall, Pennsylvania 19008

Dear Mr. Orr:

We have reviewed the Draft Programmatic Environmental Impact Statement (EIS) for the Proposed Cooperative 5-year (1981-1985) Spruce Budworm Management Program for Maine. We are responding on behalf of the Public Health Service.

We support the choice of the third alternative to increase silviculture and utilization marketing while reducing the use of chemicals and increasing the use of biological control measures. From our perspective, a method of integrated pest management is far more desirable and poses less of an insult to the human environment than broad and exclusive use of chemicals. 15

On Page 41 it is stated that adverse effects from harvesting timber could result, such as dust, siltation, and soil displacement. Also, it mentions that these effects are avoidable. We did not find a commitment in this DEIS to minimize these effects. 5

We suggest that public awareness and close communication continue to be maintained with all persons who own property, work, or live in and around the management area with respect to any actions that will be implemented. 4

We have reviewed the subject report for vector-borne disease impacts. The management program proposed will not, in our view, enhance local mosquito populations or create other untoward situations which could precipitate an increase in vector-borne diseases.

Thank you for the opportunity of reviewing this document. Please send us a copy of the Final EIS when it is issued.

Sincerely yours,

Frank S. Lisella

Frank S. Lisella, Ph.D.
Chief, Environmental Affairs Group
Environmental Health Services Division
Bureau of State Services

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
NEW ENGLAND REGION
12 NEW ENGLAND EXECUTIVE PARK
BURLINGTON, MASS. 01803

(7)

December 3, 1980

Tel: (617) 273-7233

Mr. Allen J. Schacht
Area Director
USDA, Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Schacht:

In reference to your letter of October 8, 1980, we have reviewed the Draft Programmatic EIS for Spruce Bedworm Management Program for Maine and have the following comments.

We do not anticipate any direct adverse environmental impacts of the program on airports in the New England Region. However, we would like to point out a potential safety problem associated with the implementation of the program. The location of spray tanks on airports should be carefully planned and coordinated with the State of Maine Department of Transportation and FAA. This coordination is necessary to assure that the spray tanks and other equipment are not located in areas on and around an airport that might result in the penetration of surfaces as defined in Federal Aviation Regulations Part 77, "Objects Affecting Navigable Air Space". These surfaces should be kept clear of obstructions.

We would be prepared to provide obstruction evaluation of the location of any proposed spray tank and related equipments on the airports in the region, and would appreciate your keeping us informed well in advance of such location plans. 4

We appreciate the opportunity to review the potential impacts of the proposed program on aviation activities.

Sincerely,

Vince Scarano

VINCENT A. SCARANO
Chief, Plans/Programs Branch

cc: Mr. DiPietro, Maine DOT

RECEIVED
DEC 5 REC'D

Environment Canada Environnement Canada

Environmental Protection Service,
16th Floor Bank of Montreal,
5151 George Street,
Halifax, N.S. B3J 1M5.

November 26, 1980.

Your file Votre référence

Our file Notre référence 4355-2

Mr. Alan J. Schacht,
Director,
Northeastern Area,
State and Private Forestry,
U.S.D.A. Forest Service,
370 Reed Road,
Broomall, Penn.
U.S.A. 19008.

Dear Mr. Schacht:

I will not be commenting on the draft programatic EIS on the five year Maine spruce budworm management program. Nevertheless, I would like to remain on the mailing list. Please note my change of address to:

5th Floor, Queen Square,
45 Alderney Drive,
Dartmouth, N.S. B2Y 2N6.

Yours truly,

R. Wilson, Chief,
Environmental Systems Division,
Contaminants & Assessments Branch.

RW/jk

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DIRECTOR, NA-S & PF COOP.
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a. m.

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THE SUNRISE COUNTY

WASHINGTON COUNTY
REGIONAL PLANNING COMMISSION

P.O. BOX 273 63 MAIN STREET MACHIAS, MAINE 04654 TEL. (207) 255-8686

DEC 0 8 1980

November 26, 1980

Allen J. Schacht
Area Director
United State Department of Agriculture
Forest Service
370 Reed Road
Brodmall, PA 19008

Subject: Proposed cooperative 5-year spruce budworm management program for Maine.

At its regular meeting November 25, 1980 the RPC's Executive Committee discussed this program with interest. At the conclusion of the discussion, they agreed that neither they nor their staff have the expertise to submit comments upon it. There are other agencies who will be submitting knowledgeable comments, and the Committee defers to them.

Thank you for the opportunity to review this program.

Sincerely,

Lanier C. Greer
Executive Director

LCG/as

DEC 8 1980 (10)

UNION CARBIDE
AGRICULTURAL PRODUCTS COMPANY, INC.
1595 W. CENTRE, PORTAGE, MICHIGAN 49002
616/323-2451

December 4, 1980

Mr. Allen J. Schacht, Director
Northeastern Area, State and Private Forestry
USDA Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Schacht:

Thank you for sending a copy of the "Environmental Impact Statement, Proposed Cooperative 5-Year (1981-85) Spruce Budworm Management Program for Maine". We appreciate the opportunity of being able to review this document.

Concerning the statement on pre RPAR and SEVIN® carbaryl in Appendix A, pages A1 and A2, a decision by the Environmental Protection Agency should be forthcoming momentarily. During this four year pre-RPAR status on SEVIN® carbaryl, EPA has thoroughly reviewed the world literature on SEVIN® carbaryl. The data basis on this product is probably larger than any other chemical now on the market. The expected decision from EPA is that SEVIN® carbaryl will be removed from the pre-RPAR list and returned to full registration. Thank you. ✔

Sincerely,

J.P. Cartier
Senior Field Development Representative

kk

cc: A.A. Puech
T.S. Smith
E.C. Quattlebaum
K.A. Aldridge
A.F. Gambino

(11)

UNIVERSITY OF MAINE *at Orono*

School of Forest Resources

Orono, Maine 04469
207/581-2668
2669

canusa

GREEN WOODS PROJECT

DEC 9 1980

Dec. 5, 1980

Mr. Allen J. Schact, Director
Northeastern Area, State and Private Forestry
USDA Forest Service
Broomall, PA 19008

Mr. Schact:

As a forester familiar with and concerned about the future management of Maine's budworm protection program, I have reviewed the recent Draft Programmatic EIS with great interest. At the outset, I would like to applaud the Forest Service for acknowledging the need for, and lending its support to, a substantial, long-term forest protection program, which I believe is an essential part of an integrated forest management strategy to reduce the vulnerability and improve the productivity of Maine's spruce-fir resource.

Because this committment appears to be based in part on our preliminary wood-supply projections (cited as "Green Woods Project (1980)"), I, as principal author of this report, feel a strong obligation and responsibility to clarify a number of points about our analyses which are misrepresented in the Draft PEIS. I will begin with the list on p. 26 which attempts to paraphrase some of our findings:

Regarding point (1): we forecasted that the annual harvest will exceed growth only if the cut is maintained at or above 1978 levels. Obviously, if the harvest were reduced substantially, this situation would no longer prevail. ✓

Point (8) regarding forecasted growth rates: the purpose of our original statement was to show that growth rates reported in previous Forest Surveys (1958 and 1970) would no longer prevail, due to the natural aging of the spruce-fir forest and deficiency of 30-50 year-old stands. However, negative growth can only come about when the budworm-caused tree mortality exceeds the gross growth. We predict this will happen over much of the 1980's, as the protected area is reduced from the original 7 million acres to whatever level is ultimately chosen.

Last paragraph, p. 26:

The statement that our analyses "did not consider the effects of spruce budworm on the large inventory of uneven-aged stands" is totally incorrect. Our analyses were designed to apply to the entire Spruce-Fir ✓

Protection District (all softwood and mixedwood types), which we estimated comprised about 90 percent of the entire spruce-fir resource in Maine in 1979. (The District has subsequently been reduced.) As we pointed out in our report, the age structure of Maine's spruce-fir forest (including an estimate of the alleged "large inventory of uneven-aged stands") was not available to us when we conducted these simulations. Very recently, I learned that age data were obtained in the 1970 Survey, but were never published. A very preliminary summary of these data for Piscataquis County compiled by Don Seegrist do appear to show that a substantial proportion of the plots could not be classified into a single age class. It is likely that many of these stands have a structure that is quite common in Maine, in which only two age classes are present: 80+ year-old spruce that survived the 1913-19 outbreak, and 60 year-old fir which originated at that time. Our computer model essentially assumes that each of these stand components can be disaggregated, as if they were growing separately in pure stands; i.e., that 60 year-old fir grows at the same rate, regardless of whether in pure stands with other 60 year-old fir or in mixture with 90 year-old spruce. In the absence of evidence to the contrary, I believe that this necessary simplifying assumption is accurate enough to draw the kinds of broad conclusions we did about future protection requirements.

In the same paragraph (bottom of p. 26), it is stated that we did not consider the potential for increased yields through intensified management. True, we did not attempt to forecast the effects of strategies such as planting short-rotation species, although this could easily be done with our model. However, many of our results tacitly assume that many practices which commonly fall under the heading of "intensified manaagement" will be applied to ensure that assumptions are valid. For example, in our simulations stands regenerate without lag and grow along the same yield curve as the existing mature forest; furthermore, young stands (below age 40), those which go through the outbreak unprotected, and stands which regenerate during the 1959-2020 period, are all assumed to remain invulnerable to future budworm outbreaks. For these assumptions to be realized, early release treatments, precommercial thinnings, and many other practices not commonly applied in the spruce-fir forest may be required. In other words, the future protection requirements could perhaps be lower than we projected if a massive program were mounted to shorten the rotations of now-young age classes, but the actual situation could also prove to be much worse than we forecasted if nothing is done beyond current practice.

The benefit-cost analysis (Appendix E) is, in general terms, an excellent attempt to compare the economic merits of various protection alternatives over a long time period. Regarding the footnote to Table 1 (p. E-2) which refers to our forecasts of tree mortality per acre: in our simulations, which ranged from 0 to 5 million acre protection zones, protection was applied in an increasingly "targeted" fashion (to high-volume stands) as the protected area was reduced, in an attempt to simulate what would actually happen in practice. For example, Table 8 on p. 44 of our report shows that no low-volume mixedwood land is protected under a 1 million acre protection zone, and that under 3 million acres, a higher percentage of softwood type is protected than is mixedwood. Over the course of the entire outbreak, cumulative mortality on the 1 million acre zone is 6.5 cords per acre of unprotected land (38.9 million cords on 6 million acres), with 5.2 cords per acre for the 3 million acre zone (20.9 million cords on 4 million acres). Under no protection, 7.6 cords per acre die on the entire 7 million acre district, identical to the value used on p. E-2. The point is that if simple mortality-per-acre estimates are used, they should be allowed to vary in a logical relationship with the protected area, not held constant as done in Appendix E.

The same general criticism applies to the way the cutover area is calculated on p. E-1. The value of 17 cords per acre is an average for the entire spruce-fir resource, including perhaps millions of acres of young age classes that have no merchantable trees. Stands where harvesting is routinely conducted have substantially higher volumes, averaging about 25-30 cords per acre. In our simulations, harvesting was allocated to all stands between ages 50 and 100, and to the softwood and mixedwood types, in proportion to the areas occupied by each of these categories. Harvest volumes averaged between 23 and 29 cords per acre, and covered slightly less than 100 thousand acres per year, all of which are not in the protected zone. Thus, I think the estimate of 160 thousand acres per year for cutover land is far too high. 18

More importantly, it is quite unrealistic to reduce the total area under consideration (i.e., the boundaries of the spruce-fir resource) from 7 to 5 million acres, as done in the first paragraph on p. E-1, without also reducing the harvest rate by some compensatory amount. On p. E-1 and then throughout the analysis, the statewide total of 2.8 million cords of spruce-fir is used as the harvest level to apply only to this reduced zone of 5 million acres. Much of this 2.8 million cords comes from outside the revised 5 million acre zone, and would continue to do so even under the most vigorous attempt to reallocate harvests and purchased wood among various landowners and mills.

Though these two major flaws produce offsetting results (i.e., the benefit-cost analsyis is cutting too many acres but too low a volume per acre), I would strongly recommend that these analyses be redone if they are to guide a definitive long-term managment plan. Since I am not an economist, I will not comment on the theoretical merits of the analytical approach used and how it compares to ours, which simply used the differences in inventory at various future times as the benefits resulting from protection. My major point is that we have developed an analytical tool that allows us to generate much more refined estimates of the parameters needed for this analysis, and we freely offer its use for this purpose.

Some miscellaneous remarks:

The stated goal of holding fir mortality to below 5 percent (p. 33) is unrealistically low and cannot be met under any protection strategy. Our simulations show fir mortality ranging from 17 percent under full protection of 5 million acres, up to 76 percent under no protection. In my opinion, minimizing fir mortality should not be a goal at all, but a byproduct of a strategy whose goals are to sustain the current harvest level and produce a "better" future forest. I suggests its deletion. 17

On the whole the document serves quite well as an informative device for those not acquainted with the budworm-forest management problem. In this regard, there are a number of minor factual errors (in addition to the omission of the "Literature Cited" section) which should be corrected:

p. 19, last para: spruce-fir comprises nearly 80% of the softwood pulpwood cut in Maine, not 57% as stated. ✓

p. 23: the percentages of spruce and fir in the pulpwood cut are reversed; according the 1979 State of Maine "Timber Cut" report, 57% was fir and 43% was spruce. This error is serious, because it leads to the (false) impression that there has been no attempt to discriminate against fir in the harvest. ✓

Though this document applies only for 5 years, the decisions made during its life will affect forest management in Maine for at least the next 50. In this regard, my comments are offered in a constructive spirit of strengthening the final PEIS, as it will no doubt become the definitive work guiding Maine forest policy through this critically important period.

Sincerely,

Robert S. Seymour

Dr. Robert S. Seymour

DEC

(12)

Commission

Glenn H. Manuel, Commissioner
Dept. Inland Fisheries & Wildlife
Chairman

Spencer Apollonio, Commissioner
Dept. Marine Resources

Harlow "Joe" Floyd
Bangor, Maine
Public Member

ATLANTIC SEA RUN SALMON COMMISSION
34 IDAHO AVENUE
BANGOR
04401

TELEPHONE
(207) 947-8627

December 4, 1980

Mr. Peter Orr
Forest Pest Management
Northeastern Area State and
Private Forestry
370 Reed Rd.
Broomall, Pennsylvania

Dear Mr. Orr:

Our agency has reviewed the Draft Programmatic Environmental Impact Statement as proposed for spruce budworm management over the next five years.

To the best of our knowledge, the data presented and statements made concerning the effects of operational forest spraying upon aquatic organisms are accurate. Although we would prefer chemical applications be completely eliminated, we, at the very least, welcome a reduction in these applications. The choice of Alternative 3 as a basis for integrated pest management hopefully will soon be replaced by other management techniques once such alternatives are more fully developed. 15

As a reminder, waters in which Atlantic salmon are found are to be included within the scope of the critical fishery designation. In addition to these areas, hatchery water supplies should be included as well on the list of nontarget sites. 4
Although buffers reduce contamination of such sensitive areas, the utmost care should be taken when operational sprays occur near these locations. If studies indicate that operational spraying is warranted, we would prefer the use of biological controls wherever possible. 2

A list of those areas deemed as critical fisheries is appended to this letter.

Thank you for the opportunity to review the 1981-DPEIS.

Sincerely yours,

Norman R. Dube,
Fishery Biologist

NRD/jpn
attach.

River System	Watershed Size (sq. mi.)
St. Croix River	1,468
Dennys River	128.5
East Machias River	251
Machias River	460
Pleasant River	85
Narraguagus River	232
Penobscot River *	8,570

HATCHERY	LOCATION (WATERSHED)
Green Lake National Fish Hatchery	Ellsworth Falls (Union River)
Craig Brook National Fish Hatchery	East Orland (Orland River)

* At the present time, our activities are not directly involved within the 2,100 sq. mi. drainage area of the West Branch, Penobscot River.

(13)

HANCOCK COUNTY PLANNING COMMISSION

69 Main Street, Ellsworth, Me. 04605 (207)-667-7131

JAMES S. HASKELL, Jr. EXECUTIVE DIRECTOR

DEC 1980

Amherst
Aurora
Bar Harbor
Blue Hill
Brooklin
Brooksville
Bucksport
Castine
Cranberry Isles
Dedham
Deer Isle
Eastbrook
Ellsworth
Franklin
Frenchboro
Gouldsboro
Great Pond
Hancock
Isle au Haut
Lamoine
Lucerne-in-Maine
Mariaville
Mount Desert
Orland
Osborn
Otis
Penobscot
Sedgwick
Sorrento
Southwest Harbor
Stonington
Sullivan
Surry
Swan's Island
Tremont
Trenton
Verona
Waltham
Winter Harbor

November 26, 1980

Peter W. Orr, Staff Director
Forest Insect and Disease Management
Northeastern Area
State and Private Forestry
USDA Forest Service
370 Reed Road
Broomall, PA 19008

RE: Draft EIS on Maine Spruce Budworm Management Program

Dear Mr. Orr:

I am writing on behalf of the Commission's Planning and Program Review Committee. The Committee acts as a local clearinghouse responsible under the federal Office of Management and Budget Circular No. A-95 to review proposed federal and federally assisted projects and plans affecting the Hancock County region.

On November 19, 1980 the Committee reviewed your draft Environmental Impact Statement on the Maine Spruce Budworm Management Program and voted to support the study's recommended IPM program involving an increase in silviculture and utilization-marketing, while the use of chemicals is reduced and the use of biologicals is increased. The Committee also commented that the Maine Bureau of Forestry should sponsor public informational meetings on its spruce budworm management program. Such meetings, held throughout the affected regions of Maine, would better ensure general public support for the program.

15

4

The above action completes the clearinghouse review process of the Hancock County Planning Commission.

Sincerely,

Jeannette V. Duym
Committee Assistant to the
Planning and Program Review Committee

cc: Josephine Gacetta, State Clearinghouse

(14)

Paper Group

Rumford, Maine 04276
207/364-4521

Boise Cascade

December 8, 1980

Allen J. Schacht, Director
Northeastern Area, State & Private Forestry
USDA Forest Service
370 Reed Road
Broomall, PA 19008

Dear Sir:

We submit herein comments relative to the Draft Programmatic Environmental Impact Statement for the Proposed Cooperative 5-Year (1981-1985) Spruce Budworm Management Program for Maine. Our comments more specifically address preferred alternative #3 as recommended by the Impact Statement and the alternative we believe should be selected based on the evidence.

The opportunity to review this draft statement and to respond in writing is appreciated. We are extremely pleased that the USFS intends to make a 5-year commitment to help solve the budworm problem and we commend you for this action. 12

After studying the Draft Programmatic Environmental Impact Statement, Boise Cascade Paper Group, Rumford Mill respectfully offers the following comments, suggestions, and recommendations.

At the outset, please be advised that we are in complete agreement with the concept of a 5-Year Programmatic Impact Statement and the stand of a long term commitment by the USFS to combat the spruce budworm. 13 12
We also agree with the Integrated Pest Management approach in reducing the long term impact of the budworm on the Maine forest and making it less susceptible to budworm damage. 14

However, Boise Cascade does not agree with the USFS selection of preferred alternative #3 of increasing silviculture and utilization-marketing while the use of chemical insecticides is reduced and the use of biologicals is increased. 15

We believe an alternative that the USFS can and should support, based on previous budworm records and evidence in the draft impact statement, is one of an open-ended yearly spray program which would increase or eliminate the specific annual acreage limitations, in other words spraying what is deemed necessary, together with an increase in silvicultural techniques. 1 We support this open-ended spray program with no set acreages to be sprayed because it is documented that budworm population dynamics are unpredictable from year to year. The acreage sprayed would be based on budworm populations and tree conditions. Thus we need to assess yearly and adjust spray acreages accordingly based on recommendations of the Maine Forest Service entomologists after analyzing their

Paper Group

Rumford, Maine 04276
207/364-4521

Boise Cascade

data. We need this flexibility in order to successfully battle the budworm, to help reduce our reliance on chemicals, to better target our spray, and to enable us to smoothly and effectively incorporate our other components of the IPM plan. We believe evidence within the DPEIS and past budworm history could and does support this suggested alternative. In addition, the supply-demand analysis for Maine has not been completed so we don't really know how much of the forest needs protection to fully support the industry now and in the future. It makes sense to have the option of protecting as much as is needed and not be locked into an inadequate acreage. The Maine Forest Service rates 4.5 million acres of Maine as high or extreme hazard for 1981. This also suggests the need for an option of spraying more acres than alternative #3 allows. We believe alternative #3 does not adequately protect the spruce-fir resource which is so vital to the economy of the state of Maine and the nation. If evidence presented by entomologists indicates a need to spray a larger, or smaller, area we should have the option to do so. In this alternative we are suggesting the use of chemical insecticides, increasing or decreasing depending on evidence, with the use of biologicals remaining small until one is found to be proven effective. This biological acreage could and should increase if and when one is found to be effective. 2

It is stated on page vi that "much of the mortality in unprotected areas can be salvaged." This is purely assumption and one we cannot agree with. As a matter of fact, it is estimated that only about 5 - 16% of dead trees can be salvaged, according to the Green Woods Project report "Future Impacts of Spruce Budworm Management - A Dynamic Simulation of the Maine Forest 1980-2020." 7

Another very important reason we disagree with the preferred alternative #3 is the increase in biological use which means an increase in Bt use. Bt has been proven time and time again as being ineffective in budworm control and, indeed, the 1980 Bt spray results were much less than satisfactory as reported in the attached USFS summary by Imants Millers. On pages v, 35, 38, 45, and 55 in the DPEIS itself are statements that Bt is ineffective in high budworm populations, is very costly compared to effective chemicals, and is less effective than chemicals. Yet the preferred alternative would increase the use of high-cost ineffective Bt while decreasing the use of lower-cost effective chemical insecticides and, quite frankly, we cannot understand this. If and when an effective biological insecticide is developed, at a reasonable treatment cost, we would wholeheartedly support its use. There is however no sense in supporting the increased use of one that is proven ineffective. It also appears to us that preferred alternative #3 was selected on the basis of being environmentally acceptable by certain groups instead of upon scientific data and evidence which could indeed support an open-ended spray program. We should do what is right for the state and not 2

Paper Group

Rumford, Maine 04276
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buckle under to pressure groups. Much of the data presented in appendix A-1 through A-10 of the DPEIS supports the safety and effectiveness of Sevin and the other chemical insecticides. These chemicals have a proven track record and are environmentally safe when used properly, as the evidence in the DPEIS so states. We would urge the incorporation of data on Sumithion so that this chemical could be considered for use. Boise Cascade also fully supports the buffer widths for the various chemicals as set forth by the Environmental Protection Agency in Appendix H of the DPEIS and urges the State of Maine to adopt these. These buffer widths are backed by the chemicals' safety record as set forth in Appendix A. 16 4

In view of the preceding statements, past budworm history, and the evidence presented in the DPEIS, Boise Cascade urges you to reconsider the selection of preferred alternative #3 and recommends you select instead the following alternative: "An open-ended spray program having no acreage limitations and with chemical insecticides the predominant spray component, keeping the use of biological insecticides on an experimental basis while increasing the use of silvicultural applications. The increase or decrease of yearly chemical spraying would depend upon evidence presented by State of Maine entomologists to insure adequate protection of the resource to support the industry. The use of biological insecticides would remain small until one is developed that is an effective, economical alternative to chemical spray." 1

The open-ended spray program would also give more time to implement IPM programs now being developed. This alternative we have suggested would seem to enable us to be the best possible stewards of the forest land.

Again, thank you for the opportunity to review this document and to make written comments. We strongly urge you to reconsider your choice of alternative #3 and to consider our proposal.

Very truly yours,

Kerry A. Huckins

Kerry A. Huckins
Forester - Pest Control

KAH/dma
Att.

cc: Dr. Richard E. Barringer, Commissioner, Maine Department of Conservation
Kenneth G. Stratton, Director, Maine Forest Service
A. Temple Bowen Jr., Forest Insect Manager, Maine Forest Service
Henry A. Magnuson, Paper Industry Information Office

(15)

AGRICULTURAL CHEMICAL DIVISION

Stauffer CHEMICALS

Stauffer Chemical Company
Westport, Connecticut 06880 / Tel. (203) 222-3000 / Cable "Staufchem"

December 5, 1980

Mr. Peter W. Orr
Forest Pest Management
Northeastern Area State & Private Forestry
370 Reed Road
Broomall, PA 19008

Dear Mr. Orr:

This letter is in response to your request of October 8, 1980 for comments on the Proposed Cooperative 5-Year (1981-1985) Spruce Budworm Management Program for Maine, Draft Programmatic Environmental Impact Statement, USDA-FS-NA-81-01.

We are sending these comments to you in support of the use of Sumithion for Spruce Budworm control. The Impact Statement, as written, mentions that Sumithion is one of several registered insecticides for the control of Spruce Budworm; however, when the analysis of the various products is made regarding the environment, Sumithion is not mentioned. If it is to be actively considered, this information should be included. In earlier Impact Statements most of this information was included, and it could have easily been obtained and used. 16

Since this information was not used, we are pleased to present it below and request that it be included with this letter in the final Impact Statement:

Sumithion, generic name fenitronthion, is an organophosphorus insecticide which contains more than 95% of active ingredient, O,O-dimethyl O-(3-methyl-4-nitrophenyl) phosphorothioate. Because of wide insecticidal spectrum coupled with favorable residue figures, as well as relatively low mammalian toxicity, Smithion is registered in 53 countries (excluding fenitrothion by other manufacturers) in the world; Japan, far eastern and south eastern Asia, China, Middle East, western and eastern Europe, Africa, north, central and south America and Oceania, for pest control on rice, wheat, barley, pome and stone fruits, grapes, citrus, vegetables, coffee, tea, cotton and pasture. An FAO Working Party is now evaluating Sumithion for additional to stored grains to control malathion-resistant insects.

Not only for these agricultural purposes, Sumithion has been also used for non-crop protection; for forest protection in Canada and in Japan; for the control of locust and grasshoppers. Sumithion is extensively used for the control of insects of medical importance, one of the most extensive use being the control of mosquito vectors of malaria, especially after WHO successfully finished the final scale field trial in 1976.

Since 1961 WHO and FAO expert groups have been jointly evaluating toxicology and residue of pesticides annually so as to facilitate establishment of international tolerance, and as of 1976 the Joint Meeting allocate an ADI (excluding temporary ADI) for 38 out of 63 insecticides evaluated. For Sumithion an ADI of 0.005 mg/kg/day was established in 1974.

Thus, Sumithion is nowadays one of the most representative organophosphorus insecticides in the world, and as such, since 1962 approximately 55,000 tons of Sumithion have been manufactured by Sumitomo Chemical Co., Ltd., and used for various purposes mentioned above. The tendency is that its use is becoming more wide-spread and more extensive in recent years.

Mammalian Toxicology:

Toxicologically, Sumithion is definitely one of the most thoroughly investigated insecticides. Acutely Sumithion is relatively low-toxic, and the subacute no-effect level in human volunteers is 0.2 mg/kg, and except under massive exposure there has been no record of intoxication of workers engaged in manufacturing and spraying the insecticides.

Sumithion is not delayed-neurotoxic in hens acutely and subacutely, nor causes irritation and sensitization.

The compound is quite rapidly biodegradable in mammals, with no tendency of bioaccumulation in mammalian tissues.

The effects of long-term administration of Sumithion to mammals is inhibition of cholinesterase, and at doses which give rise to a significant inhibition of choloinesterase, Sumithion causes no other physiological disturbances nor any abnormal structural changes including carcinogenicity.

Sumithion is neither teratogenic in several mammalian species nor mutagenic, and no-effect level in 3-generation reproduction has been established.

Thus, based on the overall evidences of extensive investigations, enough safety margin can be assessed between toxic doses and possible human exposure, and these favorable toxicological properties of Sumithion will guarantee the long-term use of the compound for agricultural pest control as well as forest protection.

Impact on the Environment:

Sumithion emitted to the environment rapidly disappears due to various factors such as photoalteration, and adsorption and degradation in soil; the available findings clearly indicate that Sumithion is of very short persistency in the environment except under special circumstances like in jack pine foliage rich in lipid substances.

Laboratory studies afford enough supporting evidence indicating that Sumithion is easily decomposed by sunlight, by soil microorganisms, in plants, in mammals, as well as in avian and fish species, leaving no persistent, toxicologically significant residues.

The available information suggests that in certain cases operational spraying of Sumithion may effect aquatic insect fauna, but that the effects are only transiently observed, and disappear quite promptly.

Fish species are not influenced either by fallen-out Sumithion, by depletion of feed or by ingestion of the insecticide-contaminated foods.

Generally, Sumithion applied operationally causes neither acute nor short-term effects on avian species. Avian reproduction studies indicate that by much higher amount of Sumithion than that encountered in the environment egg production and hatchability as well as growth of the youngs were comparable to the control. The results imply no long-term effects on avian species.

Although adverse effects including mortality on birds by sprayed Sumithion have been sporadically reported, they are suggested to be due to climatic factors as well as multiple swathing and multiple pesticide applications.

As an insecticide, Sumithion is considered to affect to some extent terrestrial invertebrates including pollinating insects and honey bees. However, foregoing ecological investigations have revealed that the effects, if any, are slight and transient, and easily reversed.

Based on many years of forest spraying in eastern Canada with Sumithion, it is evident that when Sumithion is used by itself for Spruce Budworm control and when used properly, it has caused no long-term deteriorating effects on any non-target species in the forest environment. Data obtained over several years from Smithion applications in Maine have confirmed these conclusions.

We respectively submit that Sumithion represents one of the most desirable insecticides for use in the Spruce Budworm Program from the standpoint of its effect on the environment, human toxicology, efficacy and cost per acre.

We will be happy to supply any additional information on Sumithion at any time.

Sincerely,

H. M. Day
Sales Manager, Specialties

HMD:ac

cc: T. Bowen, Maine Dept. of Conservation
K. Stratton, Maine Dept. of Conservation

(16)

NORTHERN TIMBERLANDS DIVISION
Bucksport, Maine 04416

PAPER COMPANY

December 8, 1980

RECEIVED
DIRECTOR, NA-S & PF COOP.
DEC 11 RECD
a.m. p.m.

Mr. Allen J. Schacht, Director
Northeastern Area
State and Private Forestry
USDA Forest Service
370 Reed Road
Broomill, PA 19008

Dear Mr. Schacht:

This letter is submitted in response to the Draft Programmatic Environmental Impact Statement for the proposed cooperative five-year (1981-1985) Spruce Budworm Management Program for Maine.

By way of introduction, I am Project Leader, Spruce Budworm-Integrated Pest Management Systems for St. Regis Paper Company in Bucksport, Maine. As project leader, I am responsible for determining the most effective combination of integrated pest management systems and to successfully coordinate their implementation to provide long-term protection for our timberlands in Maine.

St. Regis strongly supports the concept of integrated pest management, which we believe to be a variety of effective biological, physical and chemical systems that will lead us towards a healthier, less susceptible and less vulnerable future forest in the State of Maine. We believe that to achieve this goal of a future healthy forest, that a program supported on a cooperative effort by Federal, State and private interests is our only course of action. -14

St. Regis believes that the Draft Programmatic Environmental Impact Statement (DPEIS) is basically sound in its stated integrated pest management approach, but we also recognize that there are some issues in this document which we feel must be addressed and will be at a later time in this letter.

I would like to begin by stating some of the more important reasons why St. Regis is so seriously concerned with the spruce budworm situation in Maine.

In Maine, St. Regis' ownership is approximately 750,000 acres of which 78 percent of the productive forestland is considered to be in a forest type that is susceptible to attack by the spruce budworm. St. Regis owns and operates in Maine a pulp and paper mill and a high production sawmill, both of which are highly dependent on the spruce-fir resource. The requirement of spruce and fir needed by our processing mills is supplied both from

our own company lands and also from many small non-industrial ownerships. With the responsibility of meeting the future fiber demand for our processing mills, St. Regis is strongly committed to protecting and perpetuating the spruce-fir resource in the State of Maine.

As mentioned above, we at St. Regis believe that the integrated pest management approach is the key to achieving a future forest which is less susceptible and less vulnerable to the spruce budworm.

In Maine, St. Regis has begun to integrate into a cohesive scheme; many physical, chemical and biological systems; which we believe will lead us towards our future goals. At this time, I would like to discuss some of these systems.

Physical Systems

Over the past years, through aerial flights and ground surveys, St. Regis has targeted harvesting on salvage and presalvage areas. In 1980, at a substantial cost, St. Regis purchased complete coverage of color infrared photography for its entire ownership in Maine. Along with the photography, we also purchased sophisticated photo interpretation equipment so as to attain accurate assessment of the budworm damage on our ownership. Through the collection of this type of information, we believe that harvesting systems can be planned more accurately and effectively, so as to minimize the losses of this most valuable resource. 5

We have conducted on a large scale basis many management practices such as precommercial thinning, commercial thinning, marked wood selective cuts, renewal cuts, prescribed burning for site preparation, and tree planting. St. Regis believes that our future in Maine is highly dependent on investments in these types of physical systems, so that we are establishing and perpetuating more vigorous as well as less vulnerable stands to the destructive spruce budworm.

Chemical Systems

St. Regis realizes that the use of chemical insecticides is but one system in an integrated pest management program. We recognize that the design or objective of an integrated pest management program is to eventually reduce the need of chemical systems, rather than to sustain them. But we also recognize the reality of our situation in Maine and acknowledge that chemical systems have proven to be the most effective and that in the short-term will have to be highly dependent upon to allow protection to our forests, which in return will provide us with a sustained flow of spruce and fir products over the many years ahead. 8

In August of 1980, St. Regis conducted an egg-mass population survey. This population analysis in combination with other tools such as aerial flights, ground surveys and the use of the color infrared photography will allow us to be able to target spray operations more accurately and effectively for the 1981 suppression project.

We are also performing a literature research in the field of population dynamics, so that we may better understand the biology of the insect and hopefully in combination with other tools, we will be able to predict damage more scientifically and take the necessary steps to minimize it.

Biological Systems

St. Regis recognizes that biological methods are considered socially and ecologically superior to other systems in the integrated pest management approach. We strongly believe that in the near future, through increased research and field testing that biological systems will become a major effective component of the integrated pest management program in Maine. But at the present time, based on current field tests, St. Regis believes that biological systems are and should only be considered experimental.

In 1980, a large scale aerial application of the biological insecticide Bacillus thuringiensis was conducted on St. Regis timberlands. Based on the reported U. S. Forest Service draft technical review of the areas which were treated on St. Regis timberlands, Bacillus thuringiensis was not an effective control system for providing either adequate foliage protection or population reduction. 2

At the annual CANUSA meeting, which I attended at Buffalo, New York, there was an entire day devoted to Bacillus thuringiensis as a biological control measure. After listening and speaking with the most renowned scientists in North America concerning spruce budworm, I believe, as mentioned above, that biological systems are strictly experimental and require additional research and field testing before they can be considered an effective control measure and justified on a large scale basis.

MAJOR ISSUES OF CONCERN - DPEIS

1) Spruce-fir acreage considered in the integrated pest management alternative programs.

2) Alternative five-year integrated pest management programs.

3) Evaluation criteria.

As stated in the DPEIS, the integrated pest management program would be applied to about five million acres threatened by the spruce budworm. Under the first three alternatives, three million acres would be protected with insecticides. Insecticides would be applied annually to an average of 1.1 to 1.3 million acres in this protected area, over the next five years. Some portions of the protected area would be treated with insecticides two or more times during this period. Under the fourth alternative, about one million acres would be protected with a biological insecticide and under the fifth, no acreage would be protected at all.

At this time, I would like to mention that the remaining comments in this letter will be concerned with the first three alternatives. St. Regis believes, and as indicated by the DPEIS, that the choice of either alternative number four or number five would have a catastrophic effect on the economy of Maine and consequently its people, and in that context requires no further discussion.

As stated in the DPEIS, the three million acre level of protection is primarily based on preliminary spruce-fir supply projections prepared by the Green Woods Project (1980). Although this projection is basically the only accepted information at the present, it is only preliminary. There are some questions concerning this spruce-fir supply projection in that it only considered the inventory in the even-aged stands. On page 39 of the DPEIS, it is stated that "David Field has indicated that only one-half of the spruce-fir type is managed under an even-aged system, while the other half is managed under an all-aged system". 1

Recent adoption of the Maine Spruce Budworm Management Act (sub-chapter IV-A) states specifically the funding of a spruce-fir supply demand analysis.

St. Regis' issue of concern is that the DPEIS may be premature in establishing this three million acre level of protection, considering the seriousness of the current epidemic. It is widely believed that the level of protection should be greater than the three million acres for primarily the two following reasons. First, and probably the most important is that additional protected acreage may be required to prevent a future disruption of Maine's forest economy. And second, if it is decided that only three million acres will be protected and it is shown in the future that additional acreage is needed to prevent a future disruption of the forest economy, it will probably be too late, based on the current epidemic level, to save that additional inventory in the older age classes. Whereas, if the protection acreage is increased at this time, and future projections indicate that the level is more than what is required, then the acreage can easily be targeted elsewhere in the system.

The DPEIS states the seriousness of the current, badly imbalanced age class distribution in the Maine forest. That protection would have to be maintained on the large acreage of older stands for at least

forty years in order to allow time to correct the deficiency in younger age classes. That a regulated forest in the long-term will be less susceptible and less vulnerable to the spruce budworm. The Green Woods preliminary projections go on to state that this regulated forest can easily be achieved by protecting four million acres over the next four to six decades. St. Regis supports the concept of a regulated forest, and considers this to be an issue of major concern that should be addressed in the protection analysis. 11

As mentioned throughout this letter, St. Regis is seriously concerned with the sustained flow of required products to our processing mills in Maine. Increasing budworm populations along with diminishing tree conditions on our timberlands, alarms us in terms of an insecticide program which is of sufficient size to provide protection for these future products. Presently, St. Regis is investing heavily in silvicultural systems on our timberlands in Maine so that our future forest will be more vigorous as well as less susceptible and less vulnerable to the budworm. But we strongly realize that in the short-term a heavy dependence on proven effective insecticides is very much needed to protect our older stands. We recognize that because of this unregulated forest of predominantly older age classes, that the potential for loss is very great. 5

As stated in the DPEIS, the size of the area treated annually will be based on the integrated pest management alternative adopted and the yearly biological evaluations. As shown by prior protection programs, biological conditions have varied greatly. Since 1972, programs have ranged in size from 500,000 acres treated to 3.5 million acres, with biological conditions changing annually, without any indication of a trend or pattern. This fluctuation in biological conditions is what causes the problem to be so dynamic. 1

Over the past few years, through intensified operations, both by the State and private landowners, we have been able to target our spraying much better and will continue this process, so that our treatment is directed towards only those stands which definitely warrant protection.

The DPEIS states that the preferred alternative of the U.S. Forest Service is an integrated pest management program involving an increase in silviculture and utilization marketing, while the use of chemicals is reduced and the use of biologicals is increased. 5

As mentioned many times throughout this letter, St. Regis strongly supports the concept of increased silviculture and utilization-marketing methods. We at St. Regis strongly believe that our future in Maine depends heavily on an increase in silviculture and utilization-marketing methods. We are investing heavily in this

part of the program and will continue to do so in the future. But based on current biological conditions, we cannot support the decrease of effective chemical insecticides and the increase of ineffective, inconsistent biological insecticides. As stated on page 38 of the DPEIS, "BT has usually been effective only in areas of relatively low budworm populations. Consequently the usefulness of BT may be limited because of the relatively high budworm populations that exist over much of the spruce-fir resource". There is a minimum of acres which are annually treated that contain low budworm populations. Also as stated on page 1 of the DPEIS, "High to extreme spruce budworm populations have existed on about five million acres of Maine's spruce-fir forest for the past several years. Because of the vast acreage of forest susceptible to the spruce budworm, and considering high populations, the threat of the epidemic is expected to continue for the foreseeable future". 2

A decrease in effective chemical insecticides and an increase in ineffective biological insecticides would result in an acceleration of budworm populations, a drastic worsening in tree conditions, and a more frequent schedule of insecticide treatment. With an increased biological program, areas would have to be treated annually, because of the ineffective control on populations, resulting in an increase of acreage and a substantial increase in the cost of the program.

But as stated at the beginning of this letter, St. Regis believes that in the future, effective and consistent biological systems will be a major component of the integrated pest management program. St. Regis supports the continuance of research and small scale biological field tests, so that present formulations can be improved and be made more effective on budworm populations. St. Regis will cooperate with State, Federal and other private interests to promote effective biological control measures. St. Regis has made a committment to the integrated pest management approach and we plan on strengthening the program in any acceptable manner to benefit the forests in Maine.

Our last issue of concern is the manner in which the individual alternatives were evaluated. As specified in many sections of the DPEIS, each alternative was compared against eight evaluation criterion. Each criterion was considered of equal weight. The alternative which has the highest probability of satisfying the most evaluation criteria was considered the best or the so-called preferred. 17

St. Regis does not intend on refuting the apparent value of each criterion because all are considered to be of some importance. But we would like to address the equal weight which was given to each criterion.

For example, criterion 7 given minimizes potential for long-term disruption of Maine's forest economy. This criterion is basically the program. It is the reason why we have such a program and it

is the reason why we are spending millions of dollars every year. To declare that it is equal in importance to the other criteria is not realistic. St. Regis is concerned about the validity of this evaluation system.

In closing and as mentioned at the beginning of this letter, St. Regis believes that the Draft Programmatic Environmental Impact Statement is basically sound in its stated approach to integrated pest management. That the "key" to a less susceptible and less vulnerable forest is the integrated pest management way.

We recognize that financial assistance from the U. S. Forest Service is strongly needed for full implementation of an integrated pest management program in Maine. We realize that a successful program is measured in terms of, what is best for the people and the resources of the State of Maine. This is the reason why the PEIS has to be a document which is formulated to protect and perpetuate the spruce-fir resource in the State of Maine. An environmentally sound program which is continually tailored for reasons other than the matter of concern, resource protection and perpetuation, is in the long-term not in the best interest of the people of Maine. At the current epidemic level, with increasing budworm populations and diminishing tree conditions, the path which we follow over the next five years (PEIS) is probably the most critical five years in the future of Maine's forest economy and consequently its people.

The people of the State of Maine need a program which will protect and perpetuate the spruce-fir resource at a level that will provide the required wood products for a strong forest economy over the many years ahead.

Thank you very much for giving us the opportunity to submit our comments concerning this most serious matter facing the people and forest economy of the State of Maine.

Sincerely yours,

Philip J. Malerba
Project Leader
Spruce Budworm-IPMS

PJM/ccd

cc B. Bloomgren
R. Cope
R. Griffith
H. Magnuson
P. Orr
R. Turner

(17)

COMMENTS: DRAFT PROGRAMMATIC E.I.S. : COOP SPRUCE BUDWORM MGMT., MAINE

It is distressing to have to conclude, as many people in Maine have now concluded, that a governmental public comment mechanism is pretty much an empty exercise. But the practise of merely printing up public comments, with desultory (or no) responses from the administrative officials to who they are addressed is an excellent example of the textbook democracy of public administration theory, as contrasted with real participatory democracy. (And please don't use the excuse that "all the other agencies do it, so why not us?")

Why should anyone make observations in public comments for an agency when that agency takes no action to implement valid insights? Please, with this EIS, change your ways as follows: When someone presents in public comments a reasonable argument or observation, or brings up an element which you have failed to consider and which can reasonably be considered practical and relevant, change policy accordingly. If logically and factually a comment seems to hold water and to point to or toward a particular decision, policy, or approach, please either refute or refine the argument in your response to it, or explain how you are alterring your decision(s), policies, etc., to reflect the insight offered in the comment. Unless you do this, public comment is meaningless.

Making use of reasonable public comment in policymaking will enliven the EIS process, perhaps more so than is convenient for you people, but please do it anyway. It's the only right way to use public comment, and if you do not use the comments in this way, it is not fair to ask for them. The rule should be that if you can't refute a point, accept it, and alter policy accordingly. This could be done systematically, by collecting all of the points which you see as valid new insights gleaned from public comments, and by sending these around to all those on your mailing list for examination and further comment. Those that are not refuted should become part of agency policy in the final EIS, or in subsequent yearly offerings.

The way it is now, you get reasonable suggestions and you print them and that's it. Pro forma, pure and simple, and a lot easier that way for you. But we who take the time to think through comments are doing it to affect change, not to see our comments in the next appendix. Please respond fully to all my comments, and to those of others. And if our ideas make sense, please make use of them.

1. "Integrated Pest Management" is in no way compatable with continued massive aerial spraying programs of any sort. IPM is the transition away from such programs. Under IPM some chemical insecticide or other pesticide use is tolerable, but only in emergency situations, which have not been common in the quarter century of budworm "protection". I know that in your own consciences you agree with the comment this summer by the lady who called your programmatic proposals involving continuing massive chemical use against the budworm "bullshit IPM". To use IPM as you have used the term in the impact statement is misleading, because IPM implies significant movement away from chemical pesticides. The program you are

attempting to legitimize in the programmatic EIS involves no such movement. If chemical spraying were going to be reduced dramatically in each of the coming five years, and essentially eliminated by the end of the five years, the term IPM would be appropriate.

You are suggesting that what has been done in 1980 be done for five more years, basically a stand-pat holding action, but you are calling it IPM. This is semantic deception, and it smacks of Madison Avenue hype which should have no place in government or natural resource management. Please be more accurate in your terminology. Many of us would like to see IPM actually implemented in the Maine woods. This would involve a steady progression away from massive pesticide dependence. But none of your options suggests such a progression.

Your own interpretation of Maine polls on budworm spraying is appropo here. In one year the support for no chemical spraying at all increased to a full 25% from the 21% support for this position expressed less than a year previously. Meanwhile, support for "IPM" also increased, while support for massive chemical use dropped dramatically. These people want change, as the rapid changes in their own opinions about spraying clearly demonstrate. They do not want a five year brake on change, which is the "IPM" you are promoting.

2. In this connection, all of your "alternatives" except "no action" and 500,000 acres a year of Bt spraying are the <u>same thing</u>, or essentially so.

This brings up the need for public involvement in the selection of the array of options presented in the draft EI Statements. A number of people who I've heard discussing the programmatic draft EIS have said independently (no coaching) that options (1) through (3) are "the same thing", or almost so. One option, at least, could have incorporated real IPM. 15

My other comments will be as brief as possible, since you have seen most of them before. But this time, please do make use of them.

3. <u>Budworm/spray Economics</u>

a. Why not an option in which the state gets out of budworm "protection", and all management is done by the landowners, with a specific requirement that they shoulder all liability for their actions and that any spraying outfit be fully insured. Such an option was suggested in the Lund Report a year ago. But this report was shelved by the state. Can USFS justify subsidizing a state program that shelters the sprayers against liability for their actions? What is the USFS position on this liability question, and on the need for comprehensive insurance? <u>Please answer</u>. 21

b. Does a policy of subsidization without reference to <u>need</u> serve the ends of justice? Or is justice irrelevant?

c. In cost-benefit analysis a number of factors are ommitted despite public comments, many and repeated, in previous years which have asked that these factors be considered.

For starters, there is nothing factored in to take cognizance of the fact that all the money spend on spraying is lost if spraying (if continued on a wide scale) is suddenly withdrawn. Money spent in any given year on spraying commits the future to either additional spraying or to a massive loss of all the value of past spraying. When this is considered, subsidy for spraying on a wide scale means that any cessation of spraying retroactively cancels all supposedly positive C/B calculations, making them all catastrophically negative at a stroke, except for whatever marginal benefits may have resulted from harvesting of wood in the interim that might have been lost without spraying. 18

The effect of leaving this consideration out of your cost-benefit analysis is to set up the taxpayers for a situation in which they must either continue to provide massive spray subsidies indefinitely into the future, or face the loss of all (or the bulk) of their previous contributions into a rat hole. This should be faced, in your C/B analysis. Please revise accordingly in the final EIS.

d. No C/B analysis cognizance is taken of the possibility, which has frequently been suggested, that widescale and persistant budworm outbreaks may be artifacts of widescale chemical "protection". Please build this into your cost/benefit work, or at least mention what such a finding would do to your present C/B analysis if confirmed.

e. There is no real factual or empirical basis for the C/B analysis which you do provide. Neither USFS nor Greenwoods Project, nor anyone I know of can claim to know the stand or mortality situation of the Maine woods. Each year's spray maps--and frequently the spraying that follows as well--is done over hundreds of thousands of acres that are very questionably appropriate for spraying--hardwoods, mixed woods, healthy woods, etc. This year's hazard maps (for 1981) show high and extreme hazards, once again, in areas where stand and condition known by seasoned residents and ground observers would indicate that spraying is questionable (to say the least). Where is the empirical foundation of the cost-benefit calculations? (And, even more fundamentally, where is the same foundation for the detailed, acre-by-acre justification of spraying itself. Million-acre spray jobs are hit-or-miss in the very nature of things, and if the ongoing failure of the state to provide a decent empirical basis or justification for spraying is any indication, they will always be so. The Greenwoods Project's posture on this, and their failure to honestly share the inadequacy of their data base with the public is another sad example of highly funded hype garbed up in the appearance of scholarship. Until an acre by acre survey of stand types and condition is made from air and confirmed from ground, their can be no valid cost/benefit analysis, and all spraying that is justified can only be so by hype. There are no short cuts except the ones the state and the USFS have been allowing, which are these of politics subverting science. 18

f. There is no mention of the role of expanding spruce-fir milling capacity as creating more "need" to spray. There is no discussion of how to effect and secure a <u>sustainable timber economy</u> in Maine, an economy that will be sustainable indefinitely. You have been asked to take this into account in many previous EIS comments. This belongs on p. 61 (of the draft), but on that page you limit the discussion to what you call "long term disruption" potential of the various alternatives. By long term you seem to mean a matter of decades. Please adjust the alternatives-selecting calculus in the final EIS to favor the alternative (which must first be added to the five you already have considered) which would favor a sustainable wood products economy for Maine. Our kids will just be young adults when what you are now thinking of as the "long term" is already past. How about an alternative that would help them have jobs--and their kids too. 19

g. There is nothing anywhere in the EIS about job impacts of spraying. But spraying is clearly a tool which is used in lieu of labor. Many times you have had the opportunity to hear Maine woodsworkers and woodland managers suggest methods for the management of budworm-prone woods by cutting alone. This could be done, or at least from what we have observed by careful attention to these claims, it should be tried. It would cost the landowners more than spraying, but it would eliminate the risks of spraying, and even if it were ten times as costly, the landowners, at least the large ones, could still quite easily afford it. Why not an alternative incorporating this option? Wouldn't this fill the bill legally as re the Cooperative Forestry Assistance Act? <u>Please answer</u>. 20

h. There is no discussion in cost/benefit section of external costs. These include legal defenses against lawsuits, health and environmental impact research work, security measures taken (esp. in 1980) to protect the spray aircraft against real or imagined threats, the calling of sometimes expensive special meetings such as last year's medical panel on the viral enhancement question, etc. There are also external costs borne by the public, e.g., expenses of relocation when people leave the spray area, revenues lost from tourist decisions not to come to the woods at spray time, revenue lost to organic farms which cannot get or keep certification if they are near the spray area (many potential organic producers will not even bother to apply if they are within 25 miles of a spray block. And since massive spray operations often result in massive drift for long distances, it can cogently be argued that budworm spraying wipes out any possibility of truly organic agriculture in most of Maine and, further downwind, in most of Nova Scotia as well). 18

i. There is no consideration of how, in a variety of ways that have been clearly pointed out to you guys at Broomall before, the continued subsidization of the spraying program used against budworm inhibits the development of alternatives: alternatives to spraying as well as alternative ways of using woods and woodlands and their environs in northern Maine are so inhibited, and this inhibition should be at least acknowledged in the EIS, as well as somehow factored into the C/B analysis. The subsidization is both financial and, indirectly, comes in terms of unequal law enforcement (budworm spraying is allowed to do things that would land an ordinary farmer in court). 5

j. There is nothing on how much of the benefits gained from saving timber by spraying ends up in Canada's economy, a matter which has been repeatedly brought to your attention. Any honest replication of the C/B analysis in the EIS that would take this into account would come up with negative ratios for spraying and also for ather management methods, would it not? If this reasoning is incorrect, please explain how so in the final EIS. 18

4. Budworm Spraying and the Law

The various references to aquatic organisms, drift and mis-spraying, as well as the "Performance Standards" carried over from the 1980 program, all point up the differential application of law which characterizes this as well as some other forest spray programs. 4

No scientific basis for the "Performance Standards" has ever been offered. They are a purely political set of "standards", and their purpose is to allow for law violations in budworm spraying (and perhaps ultimately in other forest spraying as well) which will take place under a sort of pre-amnesty.

Both Dylox and Sevin-4-Oil forest labels have recently been changed so that they now read "avoid direct application to (water bodies)" rather than "Do not contaminate (water bodies)" No scientific justification for these label changes has been offered, and the changes were made through manufacturer-EPA consultations which involved no public notification or input, at least not in most of the areas likely to be most directly affected by these label changes.

But even with these label changes a fait accompli, law violations will be inevitable. Instead of promising vigorous enforcement, the responsible agencies concoct formulas for law evasion.

The result is that there is no let-up in the ever-increasing threat to our Maine aquatic environment and its interdependent web of lifeforms.

5. Other Omissions and Considerations

a. No suggestions or directives are offered that might set in motion a definative survey of drift from the annual budworm effort. Such a survey, once complete, should add considerable information which could be used to found future decisions regarding requests for subsidized spraying. 4

b. There is nothing on the possibility of budworm resistance to pesticides, despite suggestive research by Smirnoff some years ago and the ongoing expression of opinions by qualified experts who say that resistance is likely or even "inevitable" when a chemical is in use against the same target insect for some time. Nor is there any discussion or economic factoring of the likelihood that after many years of massive spraying natural enemies of the budworm are likely to suffer more severe depletion than is budworm itself, leaving us with no natural controls (or impaired natural controls) in the future, and locking us in to spraying as the only available answer--yet another way in which chemical pesticide spraying on a wide scale is quite literally a societal addiction, one which you now propose to foster by subsidy for "five more years". 9

c. There is nothing on possible marine impacts of massive insecticide use, and the possibility that rivers may carry insecticides or their metabolytes to the salt water is not even given the slightest credence. But the extreme sensitivity of marine organisms to insecticides used in budworm "protection" was illustrated by the Verona lobster kill this past summer, and this points up the need for some serious consideration to be given to possible marine impacts. 9

d. There is no significant discussion of pesticide metabolytes at all--everything is couched in terms of parent compounds. The same range of consideration should be given both, and metabolytes should be traced out in a "complete inventory", from parent compound through the last possible breakdown, with consideration being given to parent compound-metabolyte interactions as well as to metabolyte-metabolyte interactions. Breakdowns should be examined in light of Maine's cold and acid, and frequently wet environmental conditions. 9

6. Statements for Which There Is No Apparant Basis (These abound, but I am listing only a few of the more important ones):

a. P. 38 suggests that there is "potential contamination of one or two organic farms in the spruce-fir protection district. What is the research basis for this suggestion, or is it, as I suspect, pollyanna guesswork? 4

b. p. 39 says that "relatively little of the Maine spruce-fir resource can be treated silviculturally in any one year". This may be so, depending upon one's definition of "relatively little". But have you at USFS bothered to interview woodsmen and woodsman labor leaders like Mel Ames and Bill Butler, who might suggest that there could and might should be much increased use of woods labor to control budworm. Such efforts might be capable of treating a lot more of the woods annually by cutting--perhaps twice as much or even more. Assumptions like this, based on current practises, limit the capacity of our society to change creatively. 6

c. The statement quoted at the end of page A-5, on drift, is very misleading ("Alpha naphthol redidues in the residential participants indicated that drift did not occur"). As we all know, Med. Univ. S. Carolina and Ernest 9

Richardson of the Maine Public Health Lab have conclusively shown that drift of up to 22 miles did occur from the budworm program. Please correct this extremely misleading statement in the final EIS.

---Larry Lack
(freelance writer)
Rt. 1
Steuben, Maine 04680

DEC 12 1980

DEC 10 (17)

DEAR EIS FOLK:

PLEASE APPEND THE FOLLOWING TO MY COMMENT ON THE PROG.EIS, MAILED YESTERDAY:

"I BELIEVE THAT THE AGRI-CHEMICAL INDUSTRY IS TAKING ADVANTAGE OF ITS CAREFULLY NURTURED TIES WITH PEOPLE IN THE UNIVERSITY TO PROMOTE ITS OWN VERSION AND SELF-DEFINITION OF INTEGRATED PEST MANAGEMENT, TO THE DETRIMENT OF THE SOUND PEST CONTROL SYSTEM WHICH SO MANY OF US HAVE BEEN STRIVING SO LONG TO DEVELOP" — ROBT. VAN DEN BOSCH (LETTER TO U. CALIF. V.P. J.B. KENDRICK - MAY 6, 1977)

EMPHASIS ADDED

LARRY LACK
STEUBEN, ME 04680

DEC 12 1980

12/10/80
Wytopitlock
Me. 04497

(18)

USDA
Forest Service:

The Draft Programmatic Environmental Impact Statement (DPEIS) presents the most important program yet proposed by Maine--five years of assured Federal funding of the use of chemical insecticides. Such a proposal requires close and careful scrutiny. I have attempted to write such a critique, but discovered I would end up with as much paper wasted as in the DPEIS. So I cut down and cut down, but the result was still unwieldy. This is an indication of the number of faults I found with the program.

I am not paid to do this. I'd certainly rather not do this. I have had to take time and make time and doing so has temporarily disrupted my family life. But after 5 years of struggle I'll not simply drown quietly in the ocean of paper that has periodically flowed this way. I have devoured it all and am ready to explode!

This cover letter serves as a summary of a lengthier work that should arrive within a day or two. I hope you have the time and patience to examine the arguments. I discuss them at length because I hope that your decisions will be based on reason and logic rather than mere political pressure.

I. The Problem.

There is no problem defined nor analyzed. Only "factors" are given. The answer is to spray, but we are not told the question. The basic elements to look at are the budworm, forest management (or mismanagement), spraying, and level of cut. The last three are variables.

II. The Goal.

There are no objectives stated, only "criteria." This is like trying to navigate without a destination. Objectives depend on who the decision maker is.

III. Methods.

The level of cut is treated as a constant. It should not be. 19
Regulating the cut is perhaps the most important method of dealing with the budworm.

IV. Effects of Methods.

A. Chemicals.

The section dealing with chemicals is incomplete and biased. The real issues are that:

1. People should not be contaminated against their will.
2. Streams and ponds need protection from contamination.

The Performance Standards are not adequate to meet such goals. 4

B. Silviculture.

Short term landowner objectives conflict with goals of budworm silviculture (BS). Of great importance is the level of technology/labor preferred by the landowners compared to the technology/labor 5
appropriate to BS.
The needs for such silviculture are demanding. The challenges great. We are losing ground with presently used techniques.

V. Alternatives.

The discussion on alternatives is confusing. 5 alternatives are listed, but there is confusion as to whom the alternatives apply to-- the landowners or the Forest Service. 3 of the alternatives would be different in insubstantial ways over a 5 year period. 5
There are really only 3 alternatives proposed:
1. Subsidize mostly chemicals and some Bt.
2. Subsidize only Bt (but chemicals could be used non-subsidized) 15
3. No subsidies for insecticides.
This was made clear in 1980 EIS, but not in the present DPEIS.

VI. Effects of Alternatives.
1. Need to differentiate between effects of subsidy and effects of actions. 13
2. If subsidy for #1 ends after 5 years, the "benefits" would change if spraying were reduced or eliminated. The program calls for long term commitment to spraying. Such a system is not stable and is subject to disruption. 18
3. Subsidizing Bt only would make Bt more cost competitive and actractive for more uses. Effects of Bt should not be judged by the same standards as chemicals. 2
4. Effects of No-Subsidy are not given adequate treatment. There is therefore little basis on which to judge whether a subsidy is justified or not.
5. The arguments concerning costs and benefits are very weak.
6. There is no discussion on the effect of subsidy on costs and benefits.
7. There is no discussion on who receives the benefits or where the money spent on spraying goes.

VII. What hits the fan.
1. There has been strong political pressure to keep the subsidies for chemical insecticide use coming .
2. The arguments used are not very convincing.
3. The DPEIS does not discuss these arguments even though they might determine whether or not subsidies are justified.

Conclusion. The DPEIS is inadequate. The preferred alternative is not justifiable given the information as presented. 15

Yours truly,
A.M. Lansky
A.M. Lansky

note. For conservation purposes I have used recycled paper. Ignore the reverse side of this document.

aml

DEC 12 1980

(19)

December 10, 1980

Peter W. Orr
Forest Pest Management
Northeastern Area State and
Private Forestry
370 Reed Road
Broomall, PA 19008

Subject: Spruce Budworm Management Program for Maine, Draft Programatic Environmental Impact Statement, USDA-FS-NA-81-01

Dear Mr. Orr:

I am the President of the Portage Lake Residents Association of the Town of Portage, Aroostook County, State of Maine. The Association is against federally funding the budworm program in the State of Maine. It is a misguided effort which has for many years shown through its own operations that it is a failure to control budworm. I write specifically regarding the assumptions made in Appendix A of the draft EIS. On page A-1, the review of the health data starts off with the erroneous assumption that the only persons like to be exposed to the spray are "loggers, rangers,wardens, company personnel, fishermen, campers, canoeists, and hikers". This assumption is evidently based, in part, on a study done in 1979 of the human population 0.6 miles from the nearest spray block. The problem with the 1979 study and the problem with the assumptions in Appendix A is that incident after incident in the previous years have shown conslusively that areas that should not have been sprayed, are sprayed. The records of the Maine Board of Pesticides Control and the U. S. Environmental Protection Agency are full of complaints of indivudals who have been sprayed, usually directly, by pilots involved in the budworm program. And for each complaint filed with these agencies, it is safe to assume there are at least 10 other incidents that go unreported because individuals do not know where they can make a complaint to or do not have the time to pursue a complaint.

13

4

It must be assumed that anyone in a town or township which is being sprayed has the possibility of being directly exposed to Carbaryl and the other chemicals used in the budworm program. The 1979 study offers very little to measure the impact of direct application to the human population. I recommend that the environmental impact statement include the effect of Carbaryl on the human population when it is so directly exposed. Until this consideration is taken into account in the EIS, it will be deficient. 9

I enclose my testimony before the Department of Agriculture, Food and Rural Resources and the Board of Pesticides Control to further explain the Association's position on the budworm program. Thank you, in advance, for considering my comments.

Sincerely,

Malcolm Nason

Malcolm Nason, President
Portage Lake Residents Association
Box 160
Portage, Maine 04768

DEC 12 1980

(20)

271 State Street Augusta, Maine 04330 207-622-3101

December 10, 1980

Mr. Peter W. Orr
Forest Pest Management
Northeastern Area State
and Private Forestry
U.S. Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Orr:

The Natural Resources Council of Maine has reviewed the USFS draft programmatic environmental impact statement for a five year spruce budworm management program in Maine. We support the concept of long range planning and long range commitments to forestry programs. However, it is not at all clear to us what force there is behind these commitments. We would appreciate clarification of that issue. 12 5

While we support many of the statements and data, we would like to register five major objections to what is in the draft.

1. Federal assistance for pesticide use should be tied to incentives for improved forest management to reduce vulnerability to pests. Unfortunately, we find nothing in this draft to enforce or even encourage good management. On page 45 it states, "The Maine Bureau of Forestry in cooperation with large landowners would seek to meet targets for applying silvicultural methods during a five year program." We think guarantees much stronger than "seeking" targets are needed. On page E-4 the draft expects landowners will "From 1981 to 1985, harvest all spruce-fir needed to supply mills from the two million threatened acres not protected with insecticides." Nowhere do we find any mention of a program to support that statement. On page 58 in the discussion of the effects of the "no action" alternative, it is stated that "Use of silvicultural methods to reduce susceptibility of future stands would probably decrease." Without positive incentive to employ silvicultural alternatives tied to federal assistance, the statement is insupportable.

NRCM would like to see a program which requires landowner commitment to reduce vulnerability to budworm and to minimize the acres needing spray before any federal assistance will be provided for spraying that landowner's acreage. Because many alternatives to accomplish this have been discussed in recent years, we are confident that a reasonable system could be imposed this year.

Jon A. Lund, President Chris Ayres, Vice President Mary Grow, Secretary Peter B. Flynn, Treasurer
Robert H. Gardiner, Jr., Executive Director Virginia E. Davis, Counsel Mark A. Ishkanian, Assistant Director

2. Federal funds should not be used to support the use of chemicals to the same degree that they are used to support biological insecticides and non-insecticide alternatives. On pages 38 and 39, the implication is given that federal funds will be used for 36% of total program costs for pesticides of all kinds. That was the policy of the government two years ago. But in a dramatic step forward last year, the policy was changed to support biological spraying and other parts of the program but not for chemical application. That change was hailed as a great step forward, but now it appears that will be retracted. NRCM strongly objects to a flat percentage support for all elements of budworm control programs. 13

3. Stronger precautions to avoid environmental contamination are needed. On page 49 during the discussion of the recommended alternative, the use of buffers for certain environmentally sensitive areas is recommended. Last year the spray program respected wider buffers around water and human habitation than required by U.S. EPA minimum guidelines, resulting in a far more environmentally responsible spray project. To remove these buffers in the coming year would be an atrocity. 4

4. A shorter limit on the length of federal assistance for spruce budworm management in Maine must be applied. We are troubled by the proposals to continue public funding for long periods of time - from the five year period covered by this statement, to as much as 26 years implied by some of the cost benefit analyses. We perceive that the need for public funding arises because of the lower revenue position of the non-industrial sector. It is our position that the spraying cost should be borne by the ultimate consumer of the product, and we call for USFS to include as part of this program a study on their part of alternative funding mechanisms to ultimately enable all the costs to be shared equitably by industrial producer/consumers and non-industrial producers of raw wood products. 13 18

5. A more thorough environmental and human health protection and monitoring program should be instituted. The study documents some of the environmental problems to non-target species. It seems however to discount the significance of the elimination of several types of aquatic insects and does not disclose the suspected elimination of crayfish populations. The impact of the elimination of these species have subtle, but potentially vital impacts upon the ecosystem. These impacts are not yet known. We would urge that studies be made to determine these impacts before a commitment is made to any long term program. In addition, several potentially serious health questions need to be addressed regarding the use of carbaryl. These include the mammalian studies which demonstrate that carbaryl has immuno-suppressive capabilities. We would again urge that these studies be undertaken prior to a long term commitment to the program. 13 9

In addition to the above major objections, we would like to register three specific points of objection with the draft statement.

1. The first three alternatives for combinations of chemical and biological spray programs do not offer a broad choice of options. The acreages covered in options 1, 2, and 3 are all very similar. We think the options should be broadened to cover a wider range of acreages. 15

2. We note that the cost benefit analysis does not attempt to include environmental or health costs. This statement should be included and in our opinion the analysis should be reworked to provide a thorough cost benefit analysis. 18

3. The recommended alternative (#3) should include a reduction in acres sprayed each year. On page 49 of the draft it is stated that improved planning of spray blocks during the five year period should allow a reduction in the spray areas. We cannot calculate how much acreage reduction is possible, our estimate is that within one year 300,000 to 500,000 acres could be dropped from the acreage deserving treatment within the protection area. 1

The Natural Resources Council of Maine appreciates the opportunity to comment on the proposed draft statement and looks forward to receiving a final document which corrects these inefficiencies. If you have any questions concerning our views, we would be happy to expand upon them for you.

Sincerely yours,

Robert H. Gardiner Jr.

ROBERT H. GARDINER, JR.
Executive Director

cc: Richard Barringer
Ronald B. Davis
Ken Stratton

RHG:cc

DEC 12 1980

(21)

Northeast Operations
Winslow, Maine 04901
December 8, 1980

Mr. Peter W. Orr, Staff Director
Forest Insect and Disease Management
(215) 461 3153
USDA Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Orr:

Following careful review of the five alternatives proposed in the P.E.I.S., Scott Paper Company supports Alternative #1 - IPM involving an increase in silviculture and utilization - marketing, while the use of chemicals and biologicals remains constant. Our support of Alternative #1 is based on the following: 15

Increase Utilization and Marketing Methods

Efforts to increase the utilization and marketing of spruce budworm-killed wood will reduce the short-term economic impact of the spruce budworm epidemic and will play a necessary role in the establishment of an IPM program. It will, however, be difficult to develop a market for a material which will be abundant for a relatively short period of time, followed by a scarcity for a long period of time. In addition, an accelerated salvage program would have a significant impact on future wood supply. Whether we harvest the trees or the budworm kills them, the effect is the same -- a continued age class imbalance in the spruce-fir forest. The thrust of an IPM program should be to protect trees for an orderly harvest rather than encouraging an increased harvest to salvage dead or dying trees. The primary impact of the budworm is the loss of future wood supply. Expanding markets will not address this problem and would result in a future forest with the same age class imbalance and susceptibility to budworm as our present forest. 7

Increase in Silvicultural Methods

An increase in silvicultural activities is essential to reducing the long-term impact of the budworm. The objectives of host management are to create a forest which is less susceptible to insect attack and less vulnerable to damage while at the same time maintaining an economically productive forest. Even if the current budworm epidemic did not exist, an increase in silvicultural activity would be needed to fill the gap created by the previous budworm epidemic which resulted in the unbalanced age class distribution present in the forest today. Increased silvicultural activity and related increases in investment in the forest resource should be coupled with a commitment to protect these stands if conditions warrant. For example, silvicultural methods may involve application of methods to reduce fir as a component of existing and 5

future stands. If the spruce which remain in these stands begins to die, protection will be needed on these high value stands. 10

The silvicultural activities described in the P.E.I.S. (planting, pre-commercial thinning, shelterwoods) will all play a role in a successful IPM program. Management objectives differ, however, and attempts to quantify the amount of acreage treated in any manner may be counter-productive. For example, two landowners may wish to reduce the component of fir in future stands. One owner may achieve this by site preparation and planting and the other owner may prefer to pre-commercially thin later in the life of the stand. Both methods achieve the same goal and maximum flexibility should be encouraged rather than setting production goals (i.e. 15% of acreage harvested would be planted and site prepared). An increase in silvicultural activities should reduce dependence on chemical insecticides in the long term, however it is not likely to decrease protection needs in the short term. 5

Use of Chemicals Remains Constant

Reduction of chemical insecticide in the long term is a desirable goal. In order to achieve this objective the use of chemical insecticides must remain constant or be slightly increased in the short term. Recommendations for protection in the P.E.I.S. are based on an I.P.M. program practiced on 5 million acres of the resource, of which 3 million acres would be under insecticide protection. Harvesting and salvage operations would be concentrated on the remaining 2 million acres not under insecticide protection over a 10 year period according to the plan. We believe that the spruce and fir located on the 2 million acres will not be available for harvest over a 10 year period if a portion of this acreage is not protected. Although harvesting efforts may be concentrated on the 2 million acres, other factors such as location to markets, lack of successful protection on the 3 million acres, etc., may dictate that harvesting occur elsewhere. 1

In addition, some provision should be made for protecting stands which may require protection in the future. This includes stands of spruce, hemlock, and larch. Immature trees have now begun to show the effects of being subjected to a budworm infestation. Our protection objective in mature stands has been to prevent mortality. On younger stands our objective should be to preserve present and future growth. This may require us to intervene earlier and more frequently in order to adequately protect immature stands.

As stated in the P.E.I.S., 1.8 million acres is classified as environmentally sensitive. This represents nearly 25% of the total spruce-fir resource. We propose that chemical insecticide buffers should be identified as those set by the Environmental Protection Agency and that Bt should be used in these buffers. 2

In summary, we believe that a reduction in the use of chemicals is at this time premature. Once an area is excluded from protection, there is no opportunity to reverse the decision if it is found that more acreage needs to be protected. Results of the State of Maine's Wood Supply Analysis and the U. S.

Forest Service's Re-Inventory of Maine should be analyzed before a decision is made to reduce the amount of acreage under chemical insecticide protection. 1

We have the unique opportunity to produce a future forest which is less susceptible and vulnerable to the spruce budworm. In order to accomplish this objective, we need to protect sufficient acreage so that in the future the spruce-fir resource can be managed by foresters rather than by the budworm.

Use of Biologicals Remains Constant

The use of biological insecticides should be confined to relatively low hazard areas and in environmentally sensitive areas in the 5-year IPM program described in the P.E.I.S. Alternative 3 recommends increasing the use of biological insecticides to 150,000 acres per year by applying Bacillus thuringiensis (Bt) in timber stands away from sensitive areas. We do not believe that an increase in the use of biologicals is justified, based on available results of field applications. Support for this conclusion is as follows: 2

1.) Results of the 1980 Maine Spruce Budworm Project

Results reported by Imants Miller's (U.S.F.S.) at the CANUSA workshop on October 29, 1980 (see Attachment #1) indicate that a'though Bt was successfully applied, it was not successful in achieving desirable levels of foliage protection or population reduction.

2.) Inconsistency of Bt Results

A letter from a manufacturer of biological insecticides (see Attachment #2) describes the factors which influence the success of treatments. It is evident that the effectiveness of biologicals is more sensitive to a variety of factors which are beyond our control than are the chemical insecticides. In addition, because Bt needs to be ingested by the budworm, damp or cloudy weather following application will inhibit budworm feeding and the effectiveness of Bt is subsequently reduced. Sevin, which kills by contact as well as ingestion, is less sensitive to weather conditions.

3.) Stage of the Epidemic

Product labelling restricts the use of Bt to areas where there are fewer than 35 larvae per 18" branch. In many areas of Maine, larval populations far exceed this level. Considering the current epidemic situation which exists in Maine at this time, Bt will not be a viable alternative in preventing mortality on most stands during the next five years. Bt may play a more prominent role in the future as population levels begin to decline.

4.) Economics

The economics of Bt are such that some landowners may be priced out of the protection program. It is important to note that at the present time Bt is more expensive and less effective than chemical alternatives.

In summary, we recommend that the use of Bt remain constant and be restricted to environmentally sensitive areas and in areas of low hazard. Much basic research remains to be conducted on Bt and the thrust of the 5-year program should be to fund basic research and small field trials rather than increasing large scale operational use of Bt at this time.

Thank you for the opportunity to comment on the P.E.I.S. We believe the preparation of a 5-year spruce budworm management program represents a major step in managing successfully for the long term good of the forest resource. 12

Sincerely,

Donna Cassese
Project Forester

DMC/jpd

ATTACHMENT #2

SANDOZ, INC.
CROP PROTECTION

SANDOZ

480 CAMINO DEL RIO SOUTH
SUITE 204
SAN DIEGO, CALIFORNIA 92108
TELEPHONE
(714) 298-4343

October 20, 1980

Mr. Carl Van Husen
Budworm Management Coordinator
Scott Paper Company
Northeast Operations
Woodlands
Winslow, ME 04902

Dear Carl:

The following information deals with some of the factors that were present in both successful and unsuccessful B.t spray programs in 1979.

Factors which apparently influenced the successful treatments included:

1. Prespray density (with one exception) all less than 28 larvae/45 cm. branch. 18 inch
2. Larval development at spray time (with one exception), peak L_4.
3. Percent bud flaring (with exception of red spruce), 80-100%.
4. BIU/ha applied ranging from 20-40 in single or double applications. 8 to 16 BIU/Ac.
5. Ground level droplet density (with 3 exceptions) greater than 25/cm^2, based on Millipore filter data.
6. Spray time relative humidity mostly above 65%.
7. Weather conditions following spray application (with one exception), good.

Factors which apparently influenced poor results are:

1. High budworm prespray density - mostly in the 29-72/branch range.
2. Advanced larval development at spray time - mostly L_4 to L_6.
3. BIU/ha applied 20/ha nearly all in single application.
4. Heavy rains following application.
5. Low ground deposit (60% of treatments had 10 or less colonies/cm^2)

Sincerely,

SANDOZ, INC.

Ted Sleek
Manager of Government Affairs

TS/tms

DEC 12 1980

22

INTERNATIONAL PAPER COMPANY

9 GREEN STREET, AUGUSTA, MAINE 04330, PHONE 207 623-2931

WOOD PRODUCTS & RESOURCES
NORTHEAST REGION

December 9, 1980

Mr. Peter W. Orr
Forest Pest Management
Northeastern Area State and Private Forests
370 Reed Road
Broomall, PA 19008

Dear Mr. Orr:

We have reviewed the Draft Programmatic Environmental Impact Statement for the proposed Cooperative 5-year Maine Spruce Budworm Management Program. International Paper Company supports the concept of the programmatic approach for a 5-year program, however, the DPEIS being reviewed does not, in our opinion, fully address the long term problem. Our specific comments are as follows: 12

1. ALTERNATIVES CONSIDERED

These seem, when reviewing the backup data, to be based on the premis of fir protection only -- spruce may also need protection. 10

The first three alternatives indicate that only three million acres will be included in a chemical/biological protection program. Why are only three million acres out of nearly seven million acres being considered? 1

Additionally, within the chemical/biological protection areas, specific acreages of much lessor size have been identified for a specific class of spray material. What justification is there for this limit when dealing with such a dynamic epidemic?

2. EVALUATION OF ALTERNATIVES

Only eight criteria have been used; we suggest others are equally important as indicated in the three following examples: 17

The alternatives all indicate that some tree mortality will occur, yet the document seems to ignore the consequences of possible stand mortality. What ecological changes are associated with mortality areas such as stream buffers and game habitat?

What is the impact to annual fiber production (growth) for both spruce and fir, recognizing each as separate species, as well as the impact of growth change to the forest economy and social needs?

When evaluating chemicals, perhaps too much emphasis or priority has been given to carbaryl. We recognize that carbaryl is the preferred chemical, relatively safe with satisfactory effectivenss when used to protect fir. However, more consideration should be given to the other chemicals presently registered for use against the SBW - Trichlorfon (Dylox), Fenitrothion (Sumithion) and Acephate (Orthene). These other chemicals have different effects upon the environment including the host species. 16

3. SELECTED ALTERNATIVE NO. 3

This alternative specifically states that maximum protection would be for stands of high volume of fir. Inconsistent with this approach is the concept identified of preserving protected areas for 20 - 30 years to fill a projected short fall in timber supply; we question that present high volume stands of fir will remain 20 - 30 years in a state that fiber is satisfactory for pulpwood or sawtimber. 8

Why has so much priority been given to the biological - Bacillus thuringiensis (B.t.)? The track record for effectivenss has been very inconsistent. The 1980 results of B.t. in Maine as monitored by the USFS indicates that while the applied cost of B.t. is 3 times greater, the effectivenss is between 1/4 and 1/2 that of carbaryl. We recognize the importance and need for biologicals but question the wisdom of committing as part of a 5-year program, acreage needing protection to an unproven material. On page 38, the DPEIS covers the limited potential of B.t. 2

4. BUFFER ZONES

The rationale for the buffer zones identified on Table II, appendix H, page 5, is not included. Why is there a 1/2 mile buffer required for the chemical insecticides and 1/4 mile for B.t. when applied by helicopters and other small aircraft (larger buffer for large aircraft) around areas of human habitation? This buffer seems excessive and unwarranted and removes many acres from needed protection. The buffers are inconsistent with EPA buffers for other spray projects using the same insecticides. Is it environmentally sound to remove waterway shoreland from protection? Surely, ecological changes brought about by tree mortality need to be considered. 4

December 9, 1980

5. FEDERAL PARTICIPATION

We agree that the Federal Government should be a participant in the cost sharing of the chemical insecticides, as well as the biological spray project. A more complete cost-benefit economic analysis we feel would support Federal participation at 36% as indicated.

We appreciate the opportunity to respond to the DPEIS.

Sincerely,

Jerry R. Williams
Coordinator
Spruce Budworm Silviculture

JRW:ph

cc: D. Powell
J. Carlaw
J. Gulliver
R. Piepenbring
B. Pike

DEC 15 1980 (23)

National Forest
Products Association

Forest Industries Building • 1619 Massachusetts Avenue, N.W.
Washington, D.C. 20036 • 202/797-5800

December 8, 1980

RECEIVED
DIRECTOR, NA-S & PF COOP.
DEC 11 RECD
a. m. , p. m.

Mr. Allen J. Schacht
Director, Northeastern Area,
State and Private Forestry
USDA-Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Schacht:

Subject: Draft Programmatic Environmental Impact Statement (DEIS) on the Proposed Five-Year (1981-85) Cooperative Spruce Budworm Management Program for Maine

The National Forest Products Association (NFPA) represents more than 2,500 companies and 29 associations involved in the growing of timber and the manufacturing and distribution of lumber, plywood, and other wood products. NFPA supports a long-term commitment from the U.S. Forest Service to participate in the management of spruce budworm. The Programmatic EIS represents an improved approach to work cooperatively with Maine landowners and the Maine Department of Conservation to protect the valuable spurce-fir resource in the state. 13

Spruce budworm has been a persistent forest management problem in the state of Maine and in the eastern provinces of Canada over most of the past twenty years. In the 1970's, the infestation of budworm and the resultant damage to the fir and spruce resource reached such proportions that more man-hours have been devoted to spruce budworm-related protection than any other forest resource problem. Spruce budworm can be found in virtually every cranny of spruce-fir resource in Maine, over some 8 million acres of commercial forest land. The insect is a voracious eater and, with populations as high as they have been in recent years, whole trees can be defoliated in one or two seasons. If dead trees are not harvested within a few years, the timber loses its commercial value. The potential exists for the spruce budworm to destroy 60 million cords of the state's spruce and fir if protection is not afforded the forest.

The forest industry has recognized the long-term implications of spruce budworm and protection of the spruce-fir resource. The industry has organized, through the Spruce Budworm Policy Review Committee, research programs and budworm management strategies to

find solutions to this problem that affects all landowners, the citizens of the state of Maine, and, in the final analysis, consumers of wood and paper products. Accordingly, the five-year plan drafted in the Programmatic EIS is an improvement in the way the Forest Service has handled spruce budworm management. 12

The Forest Service has institutionally recognized that spruce budworm is not a year-to-year insect problem, or one that crops up in isolated pockets in the Northern woods. Protection of the Maine spruce-fir resource is an integral part of forest management in the Northeast, and a longer range process to ensure continued productivity of the resource is essential. The concept of a programmatic EIS enables a vastly different perspective than has been offered by the Forest Service previously. The approach is compatible with industry efforts to bring the spruce-fir forest under an effective management regime which minimizes spruce-fir damage from the budworm. The Programmatic DEIS represents a commitment by the Forest Service to participate in concert with the state and Maine landowners in spruce budworm management.

The Forest Service outlined five possible alternative strategies for spruce budworm protection to guide Forest Service participation over the next five years. The alternative chosen proposes a reduced reliance on chemical insecticides, an increased use of biological controls, and active development of better utilization and marketing practices. The forest industry supports this strategy and believes that reduced reliance on chemicals in the long term with the concomittant development of a healthy forest resource that provides a natural resistance to the budworm is to the benefit of all.

The forest industry recognizes that the problem requires a variety of responses and is interested in making sure those responsible for solving the problem have the flexibility to do so most effectively. For example, Bacillus thuringiensis (Bt), a biological control, was used to treat 200,000 acres in 1980 with unpromising results. Data from research plots showed minimal effectiveness in preventing defoliation or in reducing populations. Bt should be deemphasized in the protection program. The people making the perscriptions for budworm control should review the effectiveness of all available insecticides and determine the most appropriate applications. The following comments are offered to strengthen the Forest Service program. 2

While the Programmatic EIS is a five-year strategy with a commitment from the federal government to participate for that length of time, the economic assessment implies a continuing chemical protection program for twenty-five years. Understanding that the Programmatic EIS is a document representing a continuing planning 13

process, the inconsistency between the programs outlined in the selected alternatives at the beginning of the document and those selected for the benefit cost analysis is explainable. However, this should be made more clear. It would seem that the Forest Service needs to commit itself to a long-range program that continues beyond 5 years. 18 12

The program, as outlined, restricts the acreage to be treated to 1.1 million acres annually over the next five years. The economic assessment builds into the analysis an automatic and specific acreage reduction after the five-year period. The number of acres to be treated each year, however, is a function of larvae populations as measured by field sampling. Acreage constraints may prove detrimental if budworm populations and acreages with heavy infestation increase during any one year. The Forest Service should emphasize that the Programmatic EIS is a continuing planning document and subject to modification as conditions warrant. 1

The Programmatic EIS recognizes the nonindustrial landowner as affected by spruce budworm, but fails to develop a program to assist that ownership with protection. The nonindustrial landowner is faced with a particularly heavy hardship due to budworm defoliation. The forest industry can more easily assume a portion of the financial burdens for protection than can the nonindustrial landowner. The Forest Service should devote more attention in the EIS to the nonindustrial owner and develop a strategy to assist that ownership category with budworm protection. 3

The forest industry is convinced that it will take a long-term cooperative effort between the federal government, the state of Maine, and the landowners of Maine, to control the spruce budworm in Maine. To this end we support the Forest Service's DEIS on the Proposed Five-Year (1981-85) Cooperative Spruce Budworm Management Program for Maine. Towards the goal that spruce budworm be controlled in the most effective and efficient manner, the forest industry urges the Forest Service to allow greater flexibility in the choice of control methods and the number of acres treated. 5

Sincerely,

William H. McCredie

William H. McCredie
Assistant Vice President
Environmental Affairs

kms

DEC 15 '80 (24)

Despite what we have been hearing about reducing the amount of chemical spraying for budworm, the name is now IPM, but the game is the same. Spraying 950,000 acres with chemicals is still massive spraying. 14

Aerially applied sprays inevitably drift off target, creating unwanted and unknown exposures to pesticides. Broad-spectrum insecticides used in the program kill non-target organisms, including budworm preditors and important crop pollinators. As stated time and again in previous impact statements, we do not know the impacts on the environment of repeated applications of pesticides to areas of the spruce-fir protection district. 9

The conduct of the spruce budworm spray program must not be just compatible with theobjectives of state and federal laws but in compliance with them. This has not happened in the past and indications are, manipulations in high places are seeing to it that "prosecutorial discretion" and changes in laws with no apparent scientific justification, are providing the now legalized latitudes to gloss over the facts that the spraying cannot be kept on target or prevented from contaminating waterways.

Dylox should not be used for budworm treatments because unequivocably its label states the product is toxic to birds and other wildlife. I assume the Forest Service does not have a pied piper in its budget who will lead the forest creatures to safety from woods sprayed with Dylox. Speaking of Dylox, in 1979 Washington County was set to be sprayed with it, but the wet conditions that spring precluded its application in compliance with its label restriction: "Keep out of lakes, ponds and streams". Come December of that year, the label restrictions were changed to the more lenient, "Avoid direct application to lakes, ponds and streams". 9

We were told at the Carbaryl registration hearing in Maine recently that a similar lightening of restriction on Carbaryl has been made, at EPA but not yet printed on the Maine labels: What used to read, "Avoid contamination of water supplies, streams and ponds", now says avoid direct application.

Because the Maine Forest Service considers Carbaryl its most safe and inexpensive and effective insecticide, its has had to compromise its policy regarding the use of viral enhancing agents in budworm control formulations. The MFS decided not to use viral enhancers starting in 1976 when an emulsifier used in a New Brunswick spray was found to be a viral enhancer (a link between Reyes Syndrome and a viral enhancer was suspected). In 1979 the MFS cancelled the planned spraying of over 20,000 acres of land north of Moosehead Lake in an experiment using Matacil when this insecticide was shown to potentiate virus. Last year research at Univ. of Me., Orono showed

Carbaryl to be a potent viral enhancer of at least one common virus in humans. However, Carbaryl's "economic benefits' " outweighted the MFS's willingness to err on the side of human health safety and Carbaryl continued to be budworm control workhorse and will be again in 1981.

Absolutely no more federal (taxpayer) money should subsidize the private forest products corporations' management problems involving budworm control. It is unconscionable that the public be made to pay and take the risks of activities which benefit enormously wealthy private industry. If the paper companies want to spray, let them do it, as long as they are fully and strictly liable for this ultra-hazardous undertaking and they do it within the confines of laws which are meant for us all.

The government involvement in budworm control has resulted in heavy demand for useless paper consumption and a vest interest in self-perpetuation of jobs"needed" to investigate, pursue and justify budworm spraying. Maine people need jobs- managing our forests for sustained yields that are optimum, not maximum so that we provide for our needs today and do not decimate the woods for whatever uses our children find they must harvest trees from our forests. Current management practices are stealing from our children's future. Having control over vast areas of our state does not give these companies and our government the moral right to turn our woods into spruce/fir monoculture.

Put the planes and poisons out of your heads for a while and try prioritizing according to job development, safeguarding human health, restoring the integrity of our environment. The people in our state would then be the beneficiaries rather than Union Carbide et al.

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Inter-Departmental Memorandum

Date December 11, 1979

To Kenneth Stratton, Director — Dept. Conservation/Forestry

From Clark Granger — Dept. Conservation/Forestry

Subject Sevin-4-Oil

I talked with Dr. Maryann Jerkofsky of the Microbiology Department at Orono (581-7628). I would judge her findings to have greater adverse potential than Dr. Rozee's research which we used as a basis to cancel matacil last year.

The seriousness of the Jerkofsky research is underscored by the following factors:

1) The virus involved (Varicelles Zoster) is extremely common (causes chicken pox, shingles, herpes diseases).

2) The virus is one of those known to cause Reye Syndrome.

3) Humans carry the chicken pox virus in latent form even after recovery and the virus may have the potential of flaring up to cause other disease if triggered by certain toxins (I don't have the whole story on this yet).

Unlike the Rozee research which dealt with mouse cells, Jerkofsky's research involves human cells. We previously had Sevin-4-oil tested by the University of Pittsburg for Reye Syndrome effects and while Sevin came out negative, we learned later that the animal model used (hamsters) is a relatively poor model for studying viral pathogenesis. The positive Jerkofsky data, involving human tissue, reduces my confidence in the hamster study.

Assuming the Jerkofsky data is valid, if we stick with our present policy regarding spraying of viral potentiators we should not spray Seven-4-oil. It would seem that we must compromise either the policy or the spray project. We can do neither lightly. Our decision must be defensible in the face of almost certain challenge. Therefore I suggest that, without delay, we organize a panel of physicians and toxicologists to investigate this matter and report to us. I think it might be well to include Union Carbide's toxicologist, Herbert Moorefield, on the panel to give balance and to forestall industry criticism that the panel was loaded.

Ellen Baum expressed an interest in becoming involved at least with selection of a panel.

gdr

Please attach to my comments on final EIS

DEC 15 1980

NERBC New England River Basins Commission

141 Milk Street, Third Floor
Boston, Massachusetts 02109
Tel. 617-223-6244

(25)

December 9, 1980

Mr. Allen J. Schacht
Director
Northeastern Area State &
Private Forestry
USDA Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Schacht:

We have received and reviewed the Draft Programmatic Environmental Impact Statement, Proposed Cooperative Five-Year (1981-85) Maine Spruce Budworm Management Program, and appreciate the opportunity to comment on this report.

Our primary interest is appropriate utilization of the region's water resources and maintenance of high standards of water quality. We commend your selection of a pest management program which includes reduced use of chemicals and an increased reliance on biologicals. It would appear that your preferred alternative will bring us closer to those goals. 15

We understand that efforts are being made both to monitor the effects of current aerial pesticide spraying on surface and ground water and water related lands, and to determine more precisely what the long-term effects may be. This information is crucial and those efforts should be continued. 9

Please forward a copy of the final EIS to Charles Watson at our Maine Field Office, State Planning #38, State House, Augusta, ME 04330.

Sincerely,

Gary Turner
Deputy Director
Plan & Policy Development Division

DIRECTOR'S STAFF COPY
DEC RECD
a.m.

GT/CW/PMH

R+C #150

cc. Allen Pease, Director
SPO, Maine

Charles Watson, NERBC

DEC 15 1980 (26)

Great Northern Paper
a company of
Great Northern Nekoosa Corporation

December 10, 1980

Mr. Allen J. Schacht, Director
Northeastern Area, State and Private Forestry
U.S.D.A. Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Schacht:

Great Northern Paper has and continues to both support and implement integrated pest management systems that will ultimately reduce the susceptibility and vulnerability of the spruce-fir forest and reduce the need for chemical and biological insecticides. We are encouraged by the U.S. Forest Service and Maine Bureau of Forestry acceptance and acknowledgement that such efforts are indeed long-term and require long-term commitments from those agencies that have a responsibility for maintaining a productive forest resource in the State of Maine. The Programmatic Environmental Impact Statement is a beginning from which integrated management in Maine can further develop to the benefit of the individual landowners and to the citizens of the State. The following comments are offered for your consideration in preparing the final P.E.I.S. 14 13

The economic analysis contained in the P.E.I.S. apparently fails to consider a significant factor that is equally as important, if not more so, than mortality; growth loss. Based on a literature review and limited field measurements, it is our opinion that the reduction in growth in unprotected areas is at least 50 percent and may be as high as 70 percent. This reduction is not due to mortality, but is a direct reduction in accretion, or growth on trees that have not been killed. A significant impact such as this, although not as obvious as mortality, must be included in the analysis of costs and benefits from protection and integrated management. 18

The economic analysis fails to recognize and account for the value added in manufacture of the spruce-fir resource; a significant economic consideration to the State of Maine and it's citizens. To limit the analysis of anticipated benefits to stumpage values alone is to ignore the importance of this resource to the economy of the State.

The economic effects of the no protection alternative are not, in our opinion, adequately addressed in the P.E.I.S. and should be expanded to include the short and long-term impacts such a decision would have on the spruce-fir forest, the spruce-fir consuming industry, the small and non-industrial landowners, the economy of the state, and the general welfare of the State. 22 3

Millinocket, Maine 04462. (207) 723-5131

Four of the alternative programs propose the use of B.t. (Bacillus thuringiensis) on a substantial acreage annually. We support the continued development of this and other biological systems and feel they have the potential to play an important role at some point in the future when application rates and techniques have been established that will produce consistently effective results. In light of the statements throughout the P.E.I.S. concerning its limited efficacy and the limited opportunities to effectively utilize this material, we feel it is inappropriate to recommend its use on the scale at which it has been proposed. It appears illogical to propose the expenditure of more than a million dollars annually for the operational use of a material that the research community as a whole feels is not operationally effective. 2

We feel that the discussion of insecticides should be expanded to include all materials registered for use against the spruce budworm. Because of the longer term approach of the P.E.I.S. and the variables associated with protecting the forest resource, all registered insecticides should be evaluated in the document. 16

The objectives of integrated pest management and the use of insecticides within the context of this system must include several factors that have not been adequately considered. Although we fully recognize and accept the assumption that the preservation of existing inventories of spruce and fir is desirable and an essential aspect of the program, there are several equally important goals and objectives that should be considered.

The long term reduction of susceptibility and vulnerability of the forest depends upon our ability to manipulate the age-class structure of the forest. The current imbalanced structure is directly related to the 1910 - 1920 epidemic and the forest that resulted following that epidemic. To avoid a similar imbalance in the future is a goal of our current management programs and depends, to a large degree, on the prevention of widespread mortality and regeneration of the forest over a relatively short period of time. The prevention of extensive mortality is not limited to preservation of existing inventories alone, but plays a vital role in the orderly restructuring of the forest. 11

The success of programs such as the small woodlot management program depends on the resource wide success of integrated pest management systems. Markets for spruce and fir are limited to the existing capacity of the industry in the State. Without a comprehensive and regulated management program the short-term oversupply of dead and dying spruce and fir would seriously compromise the effectiveness of this program and the management efforts of the non-industrial and industrial landowners. Aside from the short-term losses that would result, the ability of the landowner to maintain a sustainable return from his lands over time would be lost. The adoption of integrated management systems in Maine must recognize the interdependency of the small and non-industrial landowners, the industrial landowners, and the statewide capacity to utilize the spruce-fir resource. 3 7

The alternatives considered place arbitrary restrictions on the area that will be protected and the area that will be treated in any one year over the 5 year period this program would involve. It is our position that such restrictions will limit the effectiveness of integrated management in Maine. We feel that the intensification of management in Maine and the demonstrated improvements in targeted treatments have reduced the protection area in Maine for valid management reasons. To further reduce the protection district on the basis of a single projection of supply and demand (Green Woods Model) is unwarranted. We suggest that the protection area be increased to include the spruce-fir resource as a whole and that the area eligible for treatment in any one year be based on biological criteria. While some may feel that a three million acre protection district will be sufficient to maintain the existing capacity of the spruce-fir industry in Maine, it cannot be considered as good management to arbitrarily preclude effective management on the remainder of the resource and, by so doing, eliminate the potential for expansion of the industry in the future. Indeed, the utilization and marketing opportunities will be seriously restricted should such a decision be made. The creation of new markets for spruce and fir will require significant capital investments by industries who would seek to utilize this resource in the short term. These investments cannot be expected if the long-term availability of raw materials is jeopardized by the adoption of an integrated management philosophy that recognizes only existing capacity. 1

It is noted within the P.E.I.S. that there is a strong interdependency between the industrial and non-industrial landowners in the State; an area of significant concern with respect to the protection program. It is also stated that the long-term effect of the non-industrial landowner withdrawals has not been determined. We suggest that the analysis can be approximated simply by observing that this important sector of the spruce-fir economy owns and/or manages 50 percent of the spruce-fir forest and supplies a similar percentage of fiber to the spruce-fir consuming industry. To eliminate or seriously restrict the non-industrial landowner's ability to protect their resources would have far reaching effects. At a minimum such a loss would seriously impair the non-industrial landowner's ability to generate a sustainable return from his lands over time. 3

The P.E.I.S. asserts that techniques such as silvicultural systems and utilization-marketing techniques have not been used extensively in the past. Silvicultural methods have been and continue to be used extensively. Since the early 1960's Great Northern Paper has had a policy of removing all merchantable balsam fir from the areas that we harvest. Although harvest operations alone do not represent the full spectrum of available silvicultural techniques, they have and will continue to play an important role in reducing the susceptibility and vulnerability of these areas. For example, during the recent classification of our lands, we delineated over 290,000 acres of land that had been harvested within the past 10 years and were withdrawn from the 1980 protection program for that very reason; a silvicultural reduction in vulnerability. This represents approximately 17 percent of Great Northern's total host acreage and is increasing each year as these operations continue. 5

In the utilization-marketing area as well, significant achievements have been made within the past few years. The utilization of balsam fir has been increased in our two mills to the present level of 59 percent of our total pulpwood furnish. The total inventory of Great Northern lands shows a spruce-fir ratio of 58 percent spruce and 42 percent fir. In our opinion this emphasis on the harvest and utilization of fir represents a serious and continuing effort to direct harvest operations into our most vulnerable stands and to utilize, to the extent possible, balsam fir from our lands and from the lands of others. The percentage of balsam fir in fiber purchased as roundwood from non-industrial and small landowners has increased significantly and now represents over 75 percent of our purchased wood volume in many areas. We do not intend to preclude further achievements in both the use of silvicultural systems and utilization-marketing techniques, however, to ignore the advances that have been made to date is regrettable. 5

An economic effect resulting from a longer term program of using chemical insecticides is stated to be: "possible reluctance by landowners to invest in silvicultural and utilization - marketing methods which would lead to long-term reduction in vulnerability to budworm." In our opinion, this represents a serious misconception of the role that chemical insecticides play in an integrated management system, a lack of understanding with respect to the serious impacts the spruce budworm is having on the forest, and the necessity of effective long-term protection if these techniques are to be successfully utilized. While state and federal agencies assume that effective protection has or will retard the implementation of silvicultural and utilization-marketing programs, the converse is, in fact, more responsible for the quandary many landowners are in. Intensive and extensive silvicultural programs, as well as utilization-marketing programs, require commitments of capital, manpower, and other resources; commitments that cannot be justified in the absence of a similar commitment by the responsible agencies of the state and federal governments to a long-term integrated approach to this problem. If there has been a reluctance to adopt these techniques on the part of any one group in the state, it has been a result of the tentative short-term commitments the state and federal agencies have made in the past to a long-term problem. In our opinion the Programmatic Environmental Impact Statement and the longer term approach that has been suggested can only serve to encourage the continued expansion of silvicultural and utilization-marketing techniques and will not, in any manner, restrict their use. 12

In summary we urge your consideration of the points we have raised. The success of integrated pest management is a primary objective of our management program.

Respectfully,

Robert T. Wright

Robert T. Wright
Project Leader

CC:

A. Temple Bowen, Forest Insect Manager
Kenneth G. Stratton, Director, Bureau of Forestry
R. F. Bartlett

DEC 19 1980 (27)

Rebecca S. Webber
Pinkhan Notch
Appalachian Mountain Club
Gorham, NH 03581

Allen J. Schacht, Director
Northeastern Area, State and Private Forestry
USDA Forest Service
370 Reed Road, Broomall, PA 19008

Dear Mr. Schacht,

I spent the better part of my senior year at Williams College researching and examining the Maine Spruce Budworm Spray Program and am now what you facetiously might call a "budworm enthusiast." In keeping up with the issues at hand, I did a careful, cover-to-cover, study of the Programmatic EIS for the Proposed Cooperative 5-Year (1981-1985) Spruce Budworm Management Program for Maine. Enclosed are my conclusions: they are in the form of a broad overview as well as page-by-page notes.

As a final remark, I would like to make it clear that, while I am presently employed by the Appalachian Mountain Club, the enclosed comments are my own and do not necessarily reflect the views of the AMC. I'm writing, rather, as a Maine citizen and voter. Thanks for your time!

Sincerely,

Rebecca S. Webber

The proposed "Cooperative 5-Year Spruce Budworm Management Program for Maine" sets as its goal the establishment of a successful integrated pest management (IPM) program. While the definition of IPM has many different interpretations, the Env. Impact Statement (EIS) fails to delineate the changes that will be incorporated in the future to set apart these management proposals as IPM programs compared to what is currently being done. As the EIS notes (p.iii), there is "concern that a long-term IPM program might not be significantly different from the past approach." Despite recognition of this concern, no attempt is made to tackle the validity of this criticism. It is unconvincing that the Maine forests will be managed in any more of an integrated fashion than at present and it seems both misleading and euphemistic to label the proposed five-year plans as IPM when, basically, all it does is commit the managers to five years of the status quo. The preferred alternative reduces chemical use by only 5% and introduces no new management alternatives. Is the plan's five-year duration enough to distinguish it as IPM? If its length of implementation is the only significant difference, where is the advantage in the proposal? The EIS neglects to make clear the improvements that will be gained by choosing the preferred alternative. It appears, rather, that the proposal will only gain the prestige of a new title-- IPM-- and the concomitant reduction in flexibility that a five year commitment will bring.

Perhaps the most disturbing characteristic of Proposal #3, the USDA preferred alternative, is that it commits the spruce budworm program to a minimim of five more years of dependence on chemical spraying but creates no incentives to speed and encourage the development of pest management alternatives. The plan simply announces that there will be "an increase in silviculture and utilization-marketing" and makes no provisions to ensure that such an increase will take place. Enhancement of new technology is not part of the program at all. While the EIS states that new spruce budworm management technology will be incorporated into an IPM program,

such developments can just as easily be incorporated into the present management program. The EIS is misleading in that it attributes a number of advantages only to an IPM program whereas almost all these advantages would also be accrued by the current program.

note:

p.ii: "cooperation"-- such integration of management has been in existence for many years.

p.iii: "supply-demand analysis-- the law provides for an analysis irregardless of an IPM program. 14

p.iii: "state General Fund support"-- such support will be based on the benefit of the budworm program derived by Maine citizens, not on whether it is IPM or not.

p.iii: "Research and application projects"-- these will contribute just as much to the present program and have been active in aiding past non-IPM programs.

As a final broad criticism of the EIS, it gives the illusion of choice whereas: one, the five selected alternatives are very contrived and, two, there is no alternative of simply maintaining the status quo. Note, for example, that no choice exists as a more moderate alternative between 15 proposals #3 and #4. While #3 would require the chemical spraying of 950,000 acres of forest, #4 would eliminate the use of chemicals altogether. While a non-spray proponent might agree that some spraying is necessary for a few more years to stabilize the forest, no alternative straddles the median between spraying at a level very close to what is sprayed now and not spraying at all. While it may be impractical to suddenly eliminate spraying altogether, "reduced" chemical spraying isn't a much better choice when it actually means spraying nearly a million acres, little less than the 1.2 million that Maine sprayed in 1980.

That there is no alternative for retaining the present year-to-year decison-making is unrealistic and forces the chosen proposal to be a five-year plan whether such a time commitment is an improvement on the present or not. This concern is more fundamental than the preceding questions raised: under alternative #3, chemicals would be applied yearly to an average of 950,000 acres -- why is it necessary to commit a program to such an average for five years? Such a plan seems more like an attempt to legitimize the wide-spread use of chemical pesticides. Reduction in chemical use could be achieved just as effectively, on the other hand, by establishing such a reduction as a management goal but not committing the program to a certain average of sprayed acreage. Again, the EIS offered no justification for the decision-making that took place before the five alternatives were put into their final form.

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Page-by-page comments

p.vii: the eight evaluation criteria:

1) why less than 5% mortality?

2) chosen alternative falls quite short of evaluation criteria #3-5--it is so similiar to the 1980 program that no reduction is likely in public concern, non-target contamination, or contamination of water. 17

3) alternative #3 does not provide more flexibility than present spruce budworm management if it commits the State to spraying an average of 950,000 acres a year.

p.3: assistance under the Woodlot Management Program has been inadequate in the past: funding and manpower were sufficient only for about one-half of the requests made for assistance. 3

p.12: review by the Maine Pesticides Control Board: how effective (or protective) is such review after the ease of the dismissal of the Board that took place in the spring of 1980? (In April, the Legislature passed a bill that created a completely new Pesticides Control Board, three of whose seven members, chosen by the governor, must be pro-sprayers. Pressure from pesticides-supporters in the Aroostook County potato region and the pro-spray stance of the present State House administration are likely to affect the choice of the remaining four gubernatorial appointees. The decisions made by the Maine PCB, then, are not unemcumbered by political sensitivity).

p.24: Despite the accusations that a reduction in spraying will mean a reduction in Maine employment, note here that 29% of the work force is Canadian.

p.24: What is the effect of non-competitive stumpage prices? (see paragraph 2).

p.26: The EIS maintains that 3 million acres of forest must be protected to sustain current levels of demand in the long run. How valid is this assumption in light of the graphed data on p.27 of the Programmatic EIS? (The graph on p.27 suggests that, in the long run, all levels of protection will eventually achieve the same net growth around the year 1990).

p.26: Note that the spruce-fir supply demand analysis (Green Woods Project, 1980), the study on which protection needs in this Programmatic EIS were based, considered neither the effects of "spruce budworm on the large inventory of uneven-aged stands" nor the "potential for increased yields through intensified management" (see note for p.40).

p.31: The increasing disenchantment with chemical spraying is only hinted at,and downplayed, to the point of being misleading:

1)

	1979	1980
those favoring chemicals	24%	16%
those not favoring chemicals	21%	25%

p.31 cont.:

2) Protest during the 1980 spray program was very heated, with threats of shooting down spray helicopters representing the apex of discontent.

p.35: Note the variety of chemical and biological alternatives to spraying: since an IPM program generally strives to maximize pest management efficiency while minimizing adverse impacts by integrating as many different types of management tools as possible, why does the IPM program proposed here neglect to provide even modest incentives for speeding research and development of new technology? 15

p.40: "Frank (1977) found that with intensive management of uneven-aged stands, net annual growth improves dramatically, (five times that of unmanaged stands), fir to spruce ratios decline and mortality lessens."

1) How valid, if Frank's study is accounted for, are the estimates that say 3 million acres of protection are needed to sustain current yields? Could more intensive management do it on less?

2) Why wasn't such management part of any of the IPM proposals in this EIS? 5 Why were management techniques limited to only those already in operation? Why weren't non-chemical options encouraged through taxes or other incentives?

p.42: If silvicultural activities are likely to require more employees, how much will this offset the decreases that are expected by decreasing chemical use? 20

pp.47-49: The precautions noted on these pages are the same as those taken in 1980-- the limited effectiveness of such "precautions" make such protective measures insufficient and not at all satisfactory with respect to evaluation criteria #3-#5. 4

pp.53-55: "benefit/cost ratio favorable": see notes for p.E-13.

p.56: "1 million acres [being protected] would not be sufficient to supply mills in the long term": is this taking into account salvage cutting that would be done in all other parts of the forest?

p.58: The EIS says that if no Federal money is provided to the spray program (it wasn't in 1980, except for funding for an experimental Bt project), the spraying will be done anyway, but without much or any use of Bt. Using only chemicals would be highly undesirable, especially in sensitive areas near human habitation, wetlands and regions with large numbers of waterways, and locations (such as fisheries) where non-target organisms would suffer considerably from contamination. In a sense, the threat not to use Bt is a form of blackmailing the USDA into providing assistance whereas the extra cost of Bt should (in true market conditions) be assumed by the sprayers

themselves i.e. those who are reaping the direct benefits of budworm protection. Moreover, Bt is more expensive only if the costs of environmental degradation and human health hazards are not added to the price of chemical spray.

note: a point frequently reiterated in the EIS is that chemical spraying is necessary to avoid disruption of silvicultural and market utilization methods. 6

-- how valid is this?

-- would the disruption be irreparable?

-- how would intensified management offset the disruption?

p.60: Important: use of insecticides in the 5-year plan assumes use after the 5 year period if outbreak conditions persist (there isn't much doubt that the outbreak won't continue).

p.A-9: The 5-Year Plan says that corridors and buffers will minimize water contamination. "Minimize" is a misleading term for the following reasons:

1) Buffers can act as protection for sensitive areas but they certainly don't prevent contamination. Notice on pp.H-4 and H-5 that some buffers are as narrow as 150 or 250 feet. If drift has been known to travel as far as 12 miles, how much protection is 150 feet?? 1

(Note also the % drift per feet travelled that was estimated in the study, "Buffer Policy," EPA Meeting, Maine Forest Service,(Augusta:MFS, Sept.1979). Moreover, in a public hearing conducted by the USDA in January 1980, a New Brunswick study was cited as reporting that only 35-50% of the chemicals ever reach the tree canopy).

2) While buffers around streams are nice ideas, they're difficult to put into practice. Spray planes travel fast enough to be upon a stream before they realize they should have turned their booms off. Moreover, how do they estimate the difference between 150, 250, or 500 foot buffers from the air? If the stream is ahead, how do the pilots know how soon to shut off the booms i.e. the spray? Sometimes tree cover will indicate a waterway,e.g. a dip or valley in the trees, but many small streams can simply not be discovered from a position high in the air. That means that many small streams are regularly contaminated. The scout planes in 1980 were required to fly at a higher altitude so that they could give the spray planes more advance warning of an approaching waterway but that meant a trade-off: more small streams would not be visible from that greater height. Finally, turning off one's booms for every stream is quite an inconvenience and, since the spray teams

are paid by the gallon, there's no particular incentive to be careful. Monitor planes are limited in effectiveness and enforcement powers.

p.A-18:Note the effect on bees, especially wild bees in the sprayed areas. 9

p.A-23:Note that the effect of repeated application, with respect to terrestrial insects and spiders, is unknown.

p.A-25:Again, the effect of repeated exposure is unknown; here, with respect to soil orgainsms. Note the effect of Sevin (carbaryl): it was reported to have decreased earthworm populations by as much as 60%.

p.B-1:A 1980 Health Advisory Panel recommended that there be no unconsented, uninformed exposure and that spray formulations be fully disclosed, including the so-called "inert" ingredients.However, drift and trade-secret laws make these recommendations difficult to impossible to carry out.

p.B-5:A second letter from the Health Advisory Panel emphasizes here that new data elevates potential health risk.

Note: What about the effect of the oil that Sevin is diluted in? No health data is available since oils used are so various that a study on one type of oil would have no relevance to a majority of the other types. Yet, 75,000 gallons/year are being dumped on Maine forests. 9

p.D-3: The 5-Year Plan notes that spray cards are quite inaccurate tools for measuring spray deposits yet will any changes be made to improve testing? Why not spend time on necessary logistical improvements such as this rather than employ large amounts of time, manpower and expense in projects,such as the Progrommatic EIS in question, which are of a more dubious nature and are less obviously useful??

p.E-13: It is significant that the cost/benefit values did not include:

1) recreation values
2) wildlife population and habitat or watershed values
3) human life and health values

Related points:

1) The landowners have adamantly refused to take the responsibility for the actual operations of the spray program. This is because they would then be liable for any damages that took place, particularly human health damages. (The State enjoys sovereign immunity). This is a cost, then, of spraying which they are not willing to assume; yet, why wasn't this cost included among those in the cost/benefit analysis? How can Bt be less cost effective if it doesn't incur the possibility of damage to human health (a legal suit on such a basis can be very expensive)? 18

2) For a 5 year plan, the cost/benefit ratio should be more inclusive and comprehensive.

Additional questions:

1) What are the synergistic effects of budworm spray, potato and other crop sprays, and Guthion, the chemical used on blueberries? (Guthion and Trichlorfon are very toxic when mixed). Why is the Maine coast one of the highest cancer areas? Granted the sprays used are relatively degradable, but do they degrade fast enough to be "neutral" by the time they travel downstream to public drinking sources or waterways where several chemical residues mix? 9

2) With respect to unconsented exposure:
   a) how much exposure is beyond medically recommended bounds?
   b) does "no unconsented, uninformed exposure" mean no exposure whatsoever? 9

3) Trichlorfon (Dylox) was not used in the 1980 program because of labelling requirements that couldn't be met and because it was being placed under reconsideration (pre-RPAR) due to potential health risk to non-target organisms. Commissioner of Maine Agriculture, Stewart Smith, is now proposing to make Dylox a "restricted use" chemical (under Maine's own chemical regulatory structure). This would mostly affect who would be able to use it, what sort of qualifications they would be required to have, what buffers would be necessary, etc. He's also proposing to ban the aerial spraying of Dylox. Nevertheless, according to this EIS, the chemical is being considered as a candidate for the 1981 spray program. The rationale? 9

(28)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

DEC 11 1980

Mr. Allen J. Schacht, Director
Northeastern Area, State and Private Forestry
USDA Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Schacht:

Thank you very much for your letter of October 8, 1980, enclosing the Draft Programmatic Environmental Impact Statement Proposed Cooperative 5-Year (1981-1985) Spruce Budworm Management Program for Maine, which we received on October 30, 1980.

We have completed our review and the attachments constitute the Agency's comments on this program.

Sincerely,

James M Conlon

Edwin L. Johnson
Deputy Assistant Administrator
for Pesticide Programs (TS-766)

Enclosure

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

COMMENTS ON THE DRAFT PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT PROPOSED COOPERATIVE 5-YEAR (1981-1985) SPRUCE BUDWORM MANAGEMENT PROGRAM FOR MAINE

The Office of Pesticide Programs, EPA, has reviewed this document and is making the following comments and suggestions. First of all, we would like to commend the USDA Forest Service and the Maine Department of Conservation (Bureau of Forestry) for the overall quality of the document. It is thorough, well presented, and well documented. We endorse your recognition of the need to develop a long-term management program rather than the short-term, "quick-fix" approaches which have taken place in the past. The EIS provides substantial information about the impact of spruce budworm control procedures on human health and the environment, and objectively evaluates the different alternatives (possible control strategies).

The recommended approach, Alternative 3, reduces the past reliance on complete chemical control, and provides for increased emphasis on integrated pest management (IPM) techniques, including an increase in silvicultural and utilization marketing methods, a decrease in chemical use, and an increase of biologicals. This alternative is likely to produce the most effective evolution towards a reduction of chemical insecticide application. We have further specific comments on some of the details of this alternative, and they are described below.

1. Silvicultural methods.

The proposed IPM program includes utilization of silvicultural methods. On page v, it is indicated that only a relatively small area could be treated with silvicultural methods during a five year program. On page 42 it is stated that there would be little benefit if they were carried out only for five years, and that they would have to be carried out on a continuous basis for long-term changes to occur. It is further stated that the potential long-term effectiveness of silvicultural methods in reducing spruce budworm losses has not been proven in a vast area such as Maine's spruce-fir forest. These factors would indicate that the proposed silvicultural methods may be of limited value in an IPM program. 6

The proposed IPM program includes salvage harvesting of damaged and dead trees. On page 49 it is indicated that harvest operations would be concentrated on the two million acres of threatened forest not under protection. However, it is stated on page 30 that 55% of the spruce-fir forests is inaccessible from existing roads; this factor would limit the proposed salvage operations. This acreage will require intensive management, with conscientious use of silvicultural and utilization marketing methods described (page 45), as well as frequent monitoring of effects. If the pest is not effectively controlled in the unprotected areas, they may act as a refuge of sorts in which the budworm may continue to breed and repopulate the protected areas.

Has consideration been given to replacement of some areas where tree mortality has been heavy (pages 12-13), at least on an experimental basis, with tree species not susceptible to spruce budworm? 22

2. Spruce budworm populations.

On page 1 (second paragraph, third sentence) it is stated, "Because of the vast acreage of forests susceptible to the spruce budworm and continuing high populations, the threat of the epidemic is expected to continue for the forseeable future." The benefit-cost analysis on page E-12 "assumes that the spruce budworm outbreak will continue indefinitely." Page 4 states that there have been major spruce budworm outbreaks between 1704 and 1947 at 24-76 year intervals, with durations of 5-11 years. This would appear to indicate that under normal conditions an outbreak would decline due to natural factors acting on high populations. Page 6 (Table 2) indicates that the spruce budworm spraying has been ongoing since 1954, and page 4 shows that between 1972 and 1979, almost 35 million dollars were spent in Maine. 9

The final EIS should include a discussion as to whether the pest spray programs (pages 6-7) may be connected with the inability of the natural enemies of the spruce budworm to bring the outbreak under control. 9

What are the parasites and predators of the spruce budworm which are adversely affected by the insecticide programs? What controlling effects do they exert on the budworm in the absence of chemicals? Available information should be included in the non-target organisms section (page 19) and spruce budworm management methods considered, biological methods section (page 35). 9

What insect management methods were employed prior to 1954? This information (page 7) should be included in the final EIS.

3. Protection emphasis.

It is stated on page 3 (paragraph 3) that "protection emphasis would be on stands with the highest ratio of fir to spruce." Since the silvicultural (pages 39-42) and utilization marketing (pages 42-44) methods emphasize removing fir from the system, the reason for the statement should be either elucidated or clarified.

4. Research and application projects.

The projects described briefly on pages 12-13 are noted. We would suggest attempting to obtain additional funding towards the development of additional IPM techniques, including pheromones and other biorational pesticides. We also have another suggestion concerning use of B.t. which is described below. 13

5. Economic factors.

On page 19 it is stated that "Maine currently produces about 3 percent of the softwood pulpwood produced in the United States ..." Is this a relatively constant percentage or is it higher or lower than in the past? Is Maine pulpwood successfully competing with southeastern pulpwood? Please include this information in the final EIS. ✓

Please explain in the final EIS the term "regulation" used in paragraphs (4) and (6) on page 26. ✓

The analysis on page 26 "did not consider effects of spruce budworm on the large inventory of uneven-aged stands." Since about half of the acreage is uneven-aged, it would seem appropriate for this analysis to be undertaken and included in the final EIS. ✓

6. Social factors.

We note the discussion on page 31 on the decreasing popular support for chemical use and insecticide spraying in general. We presume that these polls were one of the factors in the Service's preference for Alternative 3. Was it made clear, however, to the Maine residents, that IPM involves the use of chemicals? Were the respondents aware that the best-case option involved the use of chemicals on 86% of the treated or protected acreage? And that the worst-case option was 92%? This additional information and clarification should be included in the final EIS. Our experience shows that a large portion of the public views IPM as an alternative to chemicals rather than as a program that uses chemicals as well as other tactics. 22

7. Evaluation criteria.

The criteria listed on page 33 are well chosen and represent a responsible approach in evaluating the alternatives.

Please provide the basis for the 5% mortality criterion in the final EIS. 17

8. Management methods considered.

Please provide in the final EIS the criteria for making a chemical spray decision (page 34). Describe the biological evaluations and the hazard ratings that result in a spray decision. ✓

It is stated on page 34 that USDA-FS intends to use again some form of the 1980 EPA Performance Standards (Appendix H). If possible, it would be useful in the final EIS to be more specific in discussing any changes that might be made to these standards. We would also suggest some discussion in the 1981 - 1985 final EIS on the sensitive areas as in the 1980 Final EIS. ✓

9. O,O-Dimethyl O-(4-nitro-m-tolyl) phosphorothioate (fenitrothion, Sumithion^R).

On page 34 this insecticide is included among those which should be used in the proposed programs. It is stated that the effectiveness of Sumithion^R premix on large blocks in not known, and that Sumithion^R 8E has not been effective in Maine. Although Sumithion^R Premix is a candidate for inclusion in the spruce budworm spraying, no information on its effects have been included in the text or in the Appendix A. The effects of this insecticide should be included in the final EIS if it is to remain as a program insecticide candidate. This discussion should also include suitable buffer zones. 16

10. Bacillus thuringiensis.

The EIS states that Bacillus thuringiensis is usually effective in areas of low spruce budworm populations (page 38), and that in the program, it would be used primarily in low hazards stands and in environmentally sensitive areas (page 35). However, on page 55 it is stated that under Alternative 3, B.t. would probably have to be used on some stands with high budworm populations. Page 37 states that high population levels resurge quickly after spraying and repeated annual treatments are needed to prevent tree mortality. Because of costs and repeated treatments, some landowners may be reluctant to have their land treated with B.t. Have studies, however, been conducted to determine how repetitive the B.t. treatments must be, and whether in fact, over the long haul, it might be cheaper than reliance solely on chemical treatment, since natural factors would reduce the budworm population? Please include this information in the final EIS text. 2

The higher cost of B.t. applications (page 39) could be offset by USDA-FS providing a higher subsidy for B.t. use in the interests of environmental protection. In addition, the higher costs of B.t. application appear to result from the use of smaller aircraft, rather than same or comparable aircraft (E-7, table 4), since B.t. is used in small sensitive strips, rather than large acreage blocks, as the chemical insecticides. Please clarify this in the final EIS. 13

In addition, when compared with 1980, the proposed B.t. acreage is less in 1981 and subsequent years. In 1980, the amount covered was 200,000 acres, while the program proposed is for 150,000 acres each year.

In the assumptions (3) and (4) on page 45 (first paragraph), chemicals are stated to be more reliable than biologicals. However, has this been supported by hard data? Have biologicals been given a fair test, i.e., large enough blocks and long enough time frames? We would prefer that the final EIS either explain the assumptions that chemicals are more reliable than biologicals, or acknowledge that the assumptions lack conclusive data, or omit the assumptions altogether. 2

11. Comparison of alternatives.

As indicated above, when compared with 1980, there is an actual decrease in the acreage to be treated with biologicals, and not an increase (page 59).

We disagree that the (page 61) flexibility criterion (2) is more likely to be satisfied by Alternative 1 than Alternative 3. The mixed programs of Alternatives 2 or 3 are more likely to provide a flexible response than sole reliance on one type of pest control (in this case, chemical treatment only). We would like to see this incorporated in the final EIS. 22

12. Carbaryl residue in urine samples.

There may be an error in Table 1, page A-6. The average residue level for EPA personnel is well above the range of positive tests. ✓

13. Effects of insecticides.

While comprehensive ecological studies are lacking, it appears that carbaryl, trichlorofon, and acephate will not have a devastating or long-term impact on forest animals. Aquatic invertebrates will be accorded some measure of protection by buffer strips (A-13 to A-18) when carbaryl and trichlorofon are used.

Recent field studies indicate that forest applications of acephate, however, may result in population reductions of several bird species by emigration as well as direct bird mortality (A-20). The avian hazard of acephate must be considered in the program development. 9

14. Insecticide drift.

Page D-2 states that "Distance and amount of drift is dependent upon a large number of factors and can be controlled through application." However, there are a number of factors which cannot be controlled, such as humidity, temperature, and other climatic conditions. The following statistical information shows the effects of pesticide drift losses.

Chart 1 - Effect of several variables and groups of variables on drift.

Variables	% of total effects	
temperature	9.1	uncontrollable
relative humidty	11.6	uncontrollable
wind velocity	31.6	uncontrollable
nozzle height*	37.4	uncontrollable
droplet velocity	0.8	controllable
nozzle angle	5.5	controllable
% of droplets ≤ 100 microns	6.7	controllable

Chart 2 - Critical value of several variables which will limit the drift index.

Variables	Critical value limit
temperature	>75° F.
relative humidity	<63%
wind velocity	>6.2 mph
nozzle height	>60 inches
% droplets ≤100 microns	>4.6%

(from Smith, D.B. 1978. Drift of agricultural chemicals, Oklahoma Ag. Chem. Conf. Proc.)

The variables listed in these charts have been assigned values, based on importance, to provide an understanding of the concept of influences affecting non-target drift losses. While it is true that the amount of drift depends upon a large number of factors and can be reduced through certain application practices, approximately 50% of the variables are uncontrollable. *Due to the topography of the treatment area in Maine, the application altitudes (100' and 150') are higher when compared with the altitudes Smith used to construct these charts. The resulting nozzle height percentage value listed in Chart 1 must be heavily weighted for the Maine spray program and is therefore expected to have a negative impact on mitigating off-target drift losses.

15. Information not included.

We would suggest that the final EIS contain the following additional information.

a. The specific insecticides and rates of applications for the 1981 program.

b. The current tree hazard appraisal map and the current spruce budworm egg mass survey map. 22

c. Results of the 1980 spray program, including the effects on the buffer zones.

d. Results of the 1980 B.t. application demonstration on 200,000 acres, including the degree of foilage protection and tree mortality. ✓

e. Specific environmental monitoring plans for the program, both 1981 and subsequent years. ✓

f. We would be interested in the evaluation of residues in sensitive areas, the effect on non-target organisms, etc. The final EIS should include an analysis of data collected during previous treatment programs.

DEC 1 2 1980

(29)

Friends of the Earth

Maine Branch

P.O.BOX 2614, AUGUSTA,MAINE 04330

Following are the comments of the Maine branch of Friends of the Earth concerning the Programmatic Environmental Impact Statement on the proposed cooperative 5-year (1981-1985) Spruce budworm management program for Maine. We wil give much more extensive comments on the 1981 EIS.

1. Why just a five year plan? What will happen in 1986? We would have preferred alternative number 4 but applaud your decision to decrease chemical insecticides (to what extent remians to be seen),increase biologicals, silviculture and utilization-marketing. 12 15

2. You state that "the concern and dissatisfaction of some groups and individuals with chemical treatments could continue over the 5-year period." You can be certain that the "concern and dissatisfaction" of our organization will continue as long as the forests of Maine are inundated with chemical insecticides. 9

3. Much toobrief a mention of carbaryl's viral enhancement potential. Realizing the recommendation of the medical panel of "no uninformed or unconsented human exposure should occur during a forest operation(the active ingredient of carbaryl being responsible for the viral enhancement)" and your admission drift is inevitable it only seems logical that carbaryl should not be used.Trichlorfon being a poor subsitute (possible oncogenic,teratogenic,mutagenic and effects on bone marrow) also. 9

4. Very little mention of the effects on the aircraft pilots. It has come to our attention that the pilots are enduring the greatest risk of any human. 9

5. You state "the gains of chemical use are short term". Whose gains? Those of the corporate stockholders? After spending over $15,000,000 since 1972, the gains to the public in general have been minimal for such a tax expendature. 13

6. The grossly inadequate data on the effects of chemical insecticides on insects, wildlife, soil and aquatic organisms continues to concern us. When will this data be in? After we wipe out a few species? Nationwide, %10 of the bee population is destroyed each year through the application of chemical pesticides. 9

7. Drift. Chemical trespass. This is one of our major objections. The EPA states, "...the total elimination of all traces of spray drift from such areas may be unattainable in actual practice". Friends of the Earth mailed questionaires to 10,000 of its members east of the Missisippi river and were surprised that %0.6 considered themselves victims of spray drift (they suffered personal or property damage). You state that "Some insecticide "may"be lost through drift outside the target areas, evaporation of inactive ingredients in the formulation, accidential spills from aircraft, equipment failure and human error". You can change the word "may" to "has been and will continue to ", as all of these have happened in Maine and there's no reason to believe they will not continue to occur. 4

Thank you and please note our change of address above.

David Shiah
Chair ME/FOE

DEC 1 2 1980

(30)



PAPER INDUSTRY INFORMATION OFFICE
133 State St., Augusta, Me. 04330 • (207) 622-3166

December 10, 1980

Mr. Allen J. Schacht, Director
Northeastern Area, State and Private Forestry
USDA Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Schacht:

We have reviewed the Draft Programmatic Environmental Impact Statement (USDA-FS-NA-81-01) for the Proposed Cooperative 5-Year Maine Spruce Budworm Management Program and offer suggestions and comments in a spirit of support for the document, as follows:

(1) Specific acreage limitations on the project should be increased or eliminated from the descriptions of the alternatives. The entire eight-million acres on which spruce and fir are the dominant species are threatened by the current epidemic. In any one year as much as 5.5-million acres of the spruce-fir forest have been classified as being in "high" or "extreme" hazard condition. The acreage so classified from year to year should not be misinterpreted to mean that only those acres are threatened. Protection one year may reduce the hazard rating on the lands treated, but reinfestation and degeneration of tree vigor can return them to "high hazard" condition in a subsequent year. Risk rating for a specific acre may change from year to year, depending on conditions, but the total acreage under threat is the total eight-million acres. 1

A rationale for limiting the average acreage to be treated per year is absent from the DPEIS, but apparently stems from an assumption of a minimum acreage to provide a sustained yield resource base for existing industry at current consumption requirements and a further assumption that one-third of that acreage can be protected on an annual rotation of treatment. We suggest that this use of averages as a hard-and-fast rule would be unreasonably restrictive and arbitrarily limit the state's ability to react responsibly to any sudden, unpredictable intensification of the budworm infestation. Nearby Nova Scotia has just gone through a period of four years of budworm population decline, only to discover a resurgence of the insect in the fifth year. Budworm population dynamics are

unpredictable from one year to the next and the DPEIS should avoid attempting such a prediction in the form of a limitation on the number of acres to be treated according to an annual average.

(2) We would argue for greater flexibility in future decisions by the Maine Forest Service in its selection of spray materials to be used. The PEIS could use additional descriptive material on alternative materials which are or may become available in the next five years--specifically, Orthene and Sumithion. The DPEIS seems to concentrate on Sevin-4, Dylox and Bt, simply because they are in current usage for the program. Results from the 1980 project, furthermore, indicate that Bt has failed to meet its expectations for efficacy and we would suggest that the DPEIS assigning special status to Bt be reconsidered in light of recent USDA Forest Service efficacy reports.

16

2

(3) Additionally, we would suggest that in addition to USDA Forest Service support of Maine's spruce budworm suppression program, there should be some additional federal assistance to the small, non-industrial forest landowners. A significant portion of the lands under threat by budworm are in this ownership class, most of whose owners have been forced by economics of the state excise tax policy to withdraw from the program simply because they cannot afford the very protection they know they need.

3

Fully one half of all the wood consumed by Maine's forest industries is supplied from the small, non-industrial forest lands; yet, these lands have been priced out of the state's forest protection program. We would suggest that the USDA Forest Service consider ways in which it could supplement its overall support of the state program with additional assistance to the small, non-industrial forest landowner.

(4) We also would add to our support of the concept of a five-year PEIS the thought that the budworm problem is a long-term problem, which is better addressed with a 5-year program than with annual ones. At the same time, a five-year analysis of the impacts of the budworm on Maine's spruce-fir forest still is relatively short and does not get at the long-term economic disruptions that could be expected if the protection program were to be abandoned. It is axiomatic that the short-term implications of an uncontrolled epidemic would be the start of increased tree mortality. This mortality would become increasingly significant after the five years considered in the DPEIS and produce an unmanageable presence of dead timber and an oversupply of salvage wood for available markets. This situation would impact hardest on the small, non-industrial landowner.

12

22

The next stage to follow abandonment of the forest protection program most likely would be of even worse consequences. That is the stage to be entered after ten years of non-protection, when dead trees comprise one-half of the resource and could not be salvaged. The remaining live trees would not have added any growth because of their weakened condition. Maine would then experience

a severe shortage of wood for a period of at least 30 years, until a new forest could be grown to commercial size. Many of the forest industries would be forced out of business due to lack of raw material, while many small, non-industrial forest landowners would be forced to sell their land for its failure to provide any return on investment. 3

We realize that rules restrict what may be included in a PEIS, according to the time-frame it covers, but suggest that some commentary be devoted to the very serious long-term impacts which add to the justification for forest protection in Maine.

Sincerely,

Henry A. Magnuson
Executive Director

HAM/dm

December 10 1980

DEC 15 1980 (31)

Dear Allen J. Schacht,

In Deciding that alternative #3 is best suited as a formula to follow to Combat the Budworm Proble The U.S.D.A. Forest Service is not Really Seeing or accepting the Scope of the never ending problems that exist. With this kind of Proposa the "addiction" is still there and the is no Conclusion - Just on and on.

I would Prefer alternative #4, with a change. I agree that Chemicals insecticides should be eliminated but B.t. Should not become an addiction Replacer. There should be a goal by the end of five years to eliminate B.t. also. The problems of Drift, human error, and the fac that B.t. intervenes with the fores eco-system will not be solved. The budworm will not go away by man's spray intervention.

Warren Johnson said that "Scientif Knowledge Cannot be Translated into Practical Devices that are economicall feasible" "It will Cost more than it is worth" - to Continue spraying the forests in hopes of making econom benefits.

Finally I Can See no Justification To the wide spread use of Chemicals which have so many unknown factor about them and may be altering the genetic pool. It seems that by Continued use of Chemicals we are Reducing too many natural balances.

Why should the forest become a place where Chemicals work in Competition or more than man?

Sincerely,

Elizabeth Coakley
Leighton Pt. Road
West Pembroke
Maine 04666

DEC 15 1980 (32)

Georgia-Pacific Corporation *Woodland, Maine 04694*
Telephone (207) 427-3311

December 9, 1980

Mr. Allen J. Schacht, Director
Northeastern Area, State and Private Forestry
USDA Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Schacht:

I am writing this letter in response to the Draft Programmatic Environmental Impact Statement for the Proposed Cooperative 5-Year (1981 - 1985) Spruce Budworm Management Program for Maine.

Georgia-Pacific owns and operates a pulp and paper mill and a stud-mill in Woodland, Maine, and a plywood mill in McAdam, New Brunswick, and in 1981 our softwood waferboard plant will be coming on line. The Company owns and manages 500,000 acres of timber land in Maine, most of which is located in Washington County.

The IPM concept as presented in the PEIS strikes me as misleading. We feel that IPM's true potential lies only in the development of more budworm resistant forest to the 21st century but it has very limited impact on the reduction of existing budworm populations which are destroying the forests of today. The budworm epidemic needs to be brought under control now so the present spruce-fir forest will continue to produce a guaranteed wood supply to the mills. 14

The scope of present budworm epidemic is very large. Experimentation will not bring the budworm under control in our present forest as we no longer have time. Proven chemical insecticides are our only weapon today which can control this budworm epidemic. 8

Of the 5 million acres currently affected by this budworm epidemic, the PEIS plans on only protecting 3 million acres using insecticides over a period of the next 5 years, while writing off the remaining 2 million acres to presalvage and salvage harvesting. No reference 3

is made on the location of the spray protected and unprotected areas. We can only assume, due to the present restrictions and regulations, only the "back country" will be protected. This leaves Maine's most valuable forests, due to their easy access by good road systems and their close proximity to the mill, the labor force and the market, to be written off to presalvage and salvage. This segregation of the unprotected areas will put the landowners at a disadvantage in effectively managing their spruce-fir forest and in supplying the mills or markets with a reliable wood supply.

Can 2 million acres be presalvaged and salvaged cut effectively with even two or three times the harvesting equipment or labor commitment? How many would have to be harvested and stored before the resource is beyond utilization? If 50,000 acres are being currently within the non-spray 2 million acre area harvested annually, even by doubling the harvesting effort it would take 20 years. Will there be enough wood left to salvage in 10 years never mind 20 years? How would all this salvage wood be stored? The concept of presalvage and salvage harvesting appears only to be valid if the budworm mortality does not exceed the harvesting capabilities, storage capacity and the ability of the market to absorb the product. 7

We endorse the principles of IPM producing a more resistant forest in the 21st forest century. It should not be confused with providing protection for the present 20th century forest. The rapid reduction in the acreage sprayed with proven insecticides may prove fatal in controlling the spruce budworm on the current and even on the 21st century forest.

We hope B.T. (Bacillus thuringiesis) technology will soon be developed to give consistently reliable control of the spruce budworm within our economic limitations. However, the results of the 200,000 acre 1980 B.T. demonstration project were for the most part ineffective. On Georgia-Pacific lands B.T. was applied on over 29,000 acres of highly targeted spruce-fir stands needing protection with essentially no results. Consistently good results are needed before significant acreage is placed under B.T. treatment. The loss of a significant portion of the protection acreage due to ineffective B.T. treatment would be disasterous to a spruce budworm management program. 2

Throughout the PEIS balsam fir is used to determine the budworm management strategy. Spruce is essentially by-passed and appears to be assumed to be capable of surviving a budworm epidemic. This may be true for a short term epidemic. Spruce which has not been protected in this epidemic is starting to show mortality not to mention growth loss. A spruce budworm management program for the next five years should use spruce and fir conditions in determining the management strategy. I have serious reservations on the survivability of spruce on our land over the next five-year period, unless there is a rapid collapse of the budworm population in the next year or two.

I would like to briefly describe what Georgia-Pacific has been doing to combat the budworm and complying with IPM guidelines.

First of all, our cutting plans have been designed to get the most susceptible stand harvested as quickly as possible. A ten-year harvesting plan is used to sequence the areas to be cut year-by-year so as to minimize the losses to the budworm. This plan is not cast in stone and we have the flexibility to change the sequence based on the condition of the timber, thus to further reduce losses.

Stands that are highly susceptible to budworm damage and mortality are clearcut and planted. The clearcut acreage amounts to about 10 percent of the annual harvest and about 0.2 percent of the land base each year. The balance of our annual harvest is primarily by diameter limit, with fir being cut to 6" DBH and all other softwood being cut 10" DBH. Hemlock is also being by-passed. These cutting procedures shifts our softwood harvest heavily into the fir because of its lower diameter limit.

On our clearcuts since 1975 we have planted about 8,000 acres with 5 million trees. Most of these plantings have utilized budworm resistant species such as red pine, jack pine, black spruce and larches. In Maine we have a greenhouse complex capable of producing 1,000,000 containerized seedlings per year. We anticipate that our clearcutting and planting program will continue to remain in balance at its current level of 1200 acres and 1,000,000 trees planted per year.

Through our Cooperative Forestry Program we have been working with the small private landowner. This program was initiated in 1974 with a full time professional forester to provide free management advise to woodlot owners. In addition to receiving assistance, the owner is also assured of a first priority in selling his products to us. Our cooperative program currently has 168 owners enrolled representing over 36,000 acres.

In the past we have relied heavily on purchased wood from private woodlots to help supply our mills. While it is impossible for us to guarantee to anyone, we have always had a policy of maintaining a stable proportion of purchased wood in our supply program. If market conditions require us to cut our wood procurement, we cut both

our own Company operations and purchased wood equally. There is no reason why this practice will not continue as it is in everybody's best interest.

We welcome a sound cooperative five-year spruce budworm management program designed to assist financially and professionally in combating this serious threat to Maine's leading industry. However, we also realize that a poorly designed cooperative program through its restrictions, poor assumption and guidelines would reduce the spruce budworm management program below acceptable levels of performance. We hope this will not happen.

In conclusion I feel:

1. The Programmatic Envionmental Impact Statement is flawed because:

    a. IPM is not clearly defined, especially regarding the protection of our current spruce-fir forest. 14

    b. The rapid reduction of proven insecticide protection could be a serious mistake in protecting our current forest and in developing the IPM forest of the future. 8

    c. B.T. needs more refinement before significant acreage is placed under its protection. 2

    d. Spruce cannot be by-passed any longer in developing spruce budworm management strategies. 10

2. We have acted responsibly in trying to minimize the effect of the budworm in the long run on our lands.

3. The Federal government has the responsibility to help protect the spruce-fir forest of Maine and can do so through a sound cooperative five-year spruce budworm management program.

Sincerely,

William R. Sayward
Research Forester

WRS:jr

DEC 15 1980 (33)

DIAMOND INTERNATIONAL CORPORATION

NEW ENGLAND LAND
& TIMBER DIVISION
OLD TOWN, MAINE 04468
207—827-7711

December 10, 1980

Mr. Allen J. Schacht, Director
Northeastern Area, State and
Private Forestry
U.S.D.A. Forest Service
370 Reed Road
Broomall, PA 19008

Dear Mr. Schacht,

RE: Comment, Draft Programmatic Environmental Impact Statement
(USDA - FS - NA - 81 - 01)
Proposed Cooperative 5-Year Maine Spruce Budworm Management Program

The Maine Woodlands Department, New England Land and Timber Division of Diamond International Corporation supports the theory of the proposed 5-year Spruce Budworm Integrated Pest Management Program. 12

In review of the DPEIS, I offer the following thoughts of which should receive additional analysis and consideration.

1. The analysis process that the 5 million acre program was derived from is absent. Is this 5 million acre program with 3 million acre protected, 2 million acre non-protected, adequate to absorb the impact of erroneous assumptions? 1

2. Considering the dynamics of the spruce budworm problem, it seems adversely restrictive to place area limits on yearly protection programs. I would recommend no annual area limit. 1

3. An explanation is needed as to how it is proposed to designate protected versus non-protected areas. How will this affect various landowners? 3

4. All insecticides registered for use against spruce budworm in Maine should receive equal review. The implications of B. T. use with its questionable efficacy deserves thorough evaluation. 16 2

5. Further consideration seems necessary regarding the long-term strategy beyond the 5-year program.

6. Additional thought should be given to programs for landowners within no-spray protection areas and/or settlement regions. 3

Thank you.

Sincerely,

Kendall Huggins
Coordinator, Forest Protection Programs

/cw

DEC 15 1980

(34)

MAINE AUDUBON SOCIETY

Gilsland Farm • 118 Old Route One • Falmouth, Maine 04105 • 781-2330

December 10, 1980

Mr. Allen J. Schacht, Director
Northeastern Area, State & Private Forestry
USDA Forest Service
370 Reed Road
Broumall, PA 19008

Dear Mr. Schacht:

We are writing to comment on the Draft EIS for the Proposed Cooperative 5 year (1981-1985) Spruce Budworm Management Program for Maine.

We agree with the USDA Forest Service that the preferred alternative for managing Maine's budworm infestation over the next 5 years is through an Integrated Pest Management strategy, involving an increase in silviculture and utilization-marketing, while the use of chemicals is reduced and the use of biologicals is increased (listed as alternative three in the EIS). 15

We would like to take this opportunity, however, to once again express our concern regarding the chronic impact budworm chemicals may have on human health and the environment. 9

The research data cited in the EIS, particularly in Appendix A, raises more questions than are answered; for example: 9

1. What are the impacts of each of the metabolites formed from the degradation of budworm chemicals in the environment?

2. What are the impacts of the carrying agents and emulsifiers to the environment?

3. What are the impacts of ingesting low doses of carbaryl from multiple sources (budworm sprays, potatoes, strawberries, apples, sweet potatoes, nuts)?

4. What are the synergistic impacts of budworm chemicals and their metabolites with each other or with chemicals already found in the environment?

5. What impacts are caused by chemical persistence in the environment of a month or more? What are the impacts of varying persistence of some chemicals due to the nature of the substrate, temperature, and pH? (Acephate, for example, breaks down rapidly in soil, but relatively slowly in water.)

6. What are the long-term consequences of budworm chemicals' lethality to non-target organisms? (Populations of Plecoptera (stoneflies) and Ephemeroptera (mayflies) are reduced by more than one year after application of budworm chemicals.)

7. What impacts are caused by long-range drifting of chemicals, and such physical factors as volatility, nozzle angle and vibration, and droplet size?

8. What are the combined impacts of budworm chemical residues, potential stream sedimentation, potential heavy metal infiltration, and a steadily lowered pH (from acid precipitation) to aquatic organisms in streams within the spruce-fir protection district?

There are no easy answers for the questions posed above. Perhaps answers to some will never be found. Accordingly, these uncertainties lead us to the following conclusions:

1. The widespread aerial application of budworm chemicals must be reduced as rapidly as possible. It is only prudent to reduce the use of chemical controls when their ultimate impacts are unknown and uncontrollable.

2. Personnel and money must be allocated to continue technical monitoring and research regimens. This is the area in which the federal government can play a substantial role. Federal tax dollars should be allocated to research and monitor the impacts of budworm chemicals and find alternative, predictable and benign control methods. 9

3. If possible, alternative chemicals (such as pheromones and insect growth regulators) and biologicals (such as viruses, fungi, parasites, and predators) must be integrated into the budworm control program on an accelerated timetable. 13

We would encourage a more intensive research effort on these types of controls, with the hope of adding them to the total budworm control strategy within the 5 year management program.

We have appreciated the opportunity to comment.

Sincerely,

Cheryl Ring
Environmental Policy Coordinator

CR:vp

DEC 15 1980

35

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I

J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

December 8, 1980

Mr. Peter W. Orr
Forest Pest Management
U.S. Department of Agriculture
Forest Service
Northeastern Area State and Private Forestry
370 Reed Road
Broomall, PA 19008

RE: D-AFS-B82008-ME

Dear Mr. Orr:

In accordance with our review responsibilities under Section 309 of the Clean Air Act and the National Environmental Policy Act, we have reviewed the Draft Programmatic Environmental Impact Statement (EIS) for the proposed Cooperative Five Year (1981-1985) Spruce Budworm Management Program for Maine. The following comments are offered from the standpoint of our responsibility here in the EPA Region I Office for pesticide use regulation, and are for your use in developing the Final EIS.

We believe that the size and scope of proposed spray operations for alternatives 1-4 are those that can be managed in an acceptable manner as demonstrated by the 1980 operation. The choice of registered pesticides and the extent of their use is a State decision based largely on pre-spray predictions of severity and the economics of control. We are encouraged that alternatives 1-4, as proposed, utilize several tools in an Integrated Pest Management approach to the budworm problem and feel that this should help to assure a sustained forest resource over a much longer period of time. 4

Since May 1, 1980, the State of Maine has had a Cooperative Pesticide Enforcement Agreement under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) supported by Grant-in-Aid funds and, hence, has primary responsibility for enforcement of Federal, as well as, State laws governing pesticide use. The EPA Regional Office responsibility will be to monitor and provide oversight of the State enforcement efforts to help assure that pesticide use in Maine is carried out in a manner not inconsistent with product labeling and other FIFRA provisions.

Questions from earlier years largely remain, especially as these involve interpretation of accepted labeling and use directions specific to Maine use conditions. A primary problem is still one of spray drift from aerial application beyond the target area. Several significant steps were taken in 1980 by both State and Federal Agencies to help minimize the likelihood of spray and the inadvertant exposure of people and environmentally sensitive areas. EPA contributed to this effort by issuance of an enforcement advisory opinion and onsite monitoring and surveillance.

The EPA opinion, referenced in the draft as Appendix H, was published in the Federal Register on May 16, 1980 (45 FR 32420) entitled "Application of Certain Insecticides for Suppression of Spruce Budworm; Issuance of Advisory Opinion." The opinion which was developed specifically for the 1980 program and expired on July 31, 1980, provided performance standards and established no spray buffers for designated sensitive areas as additional operational guidance while assuring that if specified application practices were followed, the Agency would not prosecute the applicator for misuse even if small amounts of measurable spray drifts away from the target site. In practice, based upon a single season onsite monitoring experience, the application practices established in the opinion proved to be more useful as programmatic guidance to user interests than to the enforcer who was unable to measure for compliance many of the required practices.

The number of spray related incidents reported in 1980 was impressively low, suggesting that the combined efforts of both State and Federal Agencies contributed to a reduction in unknowing and unconsented exposures to humans and unwanted exposure to environmentally sensitive areas.

We believe that until such time as EPA issues a new opinion, further use of the performance standards and buffers established in the 1980 opinion, with possible improvements to further minimize risk of drift, still have practical usefulness for operational planning purposes. As such, they provide additional information for label interpretation purposes and architects of the spray operation are encouraged to utilize these as guidance in planning for spray operations to be carried out in 1981-85.

In accordance with our national rating system (see enclosed explanation) we have rated this EIS LO-1.

We appreciate the opportunity for commenting on the EIS and request that one copy of the Final EIS be sent to us when it becomes available. If you wish to discuss our comments, please contact Dr. Harold Kazmaier in our Pesticides Office at 617/223-5126.

Sincerely,

Richard R. Keppler

Richard R. Keppler
Acting Director
Environmental Impact Office

Enclosure

EXPLANATION OF EPA RATING

Environmental Impact of the Action

LO -- Lack of Objections

EPA has no objections to the proposed action as described in the draft environmental impact statement; or suggests only minor changes in the proposed action.

ER -- Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating federal agency to reassess these aspects.

EU -- Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

Adequacy of the Impact Statement

Category 1 -- Adequate

The draft environmental impact statement sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2 -- Insufficient Information

EPA believes that the draft environmental impact statement does not contain sufficient information to assess fully, the environmental impact of the proposed project or action. However, from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft environmental impact statement.

Category 3 -- Inadequate

EPA believes that the draft environmental impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the impact statement.

If a draft environmental impact statement is assigned a Category 3, no rating will be made of the project or action; since a basis does not generally exist on which to make such a determination.

(36)

December 10, 1980
Marion, Maine

Allen J. Schacht
United States Department of Agriculture Forest Service
Broomall, Pennsylvania

DEC 16 1980

Dear Mr. Schacht:

I am very sorry that my comments on the 1981 Maine Spruce Budworm Suppression Project Draft Environmental Impact Statement could not be postmarked today.

I was apparently dropped from your mailing list, in spite of my request to continue to be on it and to receive two copies of all your mailings. Thus, I did not receive the DEIS in a timely fashion. I finally requested one of the Maine Department of Conservation, and Marshall Wiebe promptly sent me one which I received during the last week in November. I have been conscientiously preparing my somewhat lengthy and, I hope, thorough comments since then, but they will not be ready for mailing until at least next Monday, December 15, 1980.

I trust my excuse is adequate, and that you will consider my comments along with those postmarked by December 10. For a start, I refer you to my comments on last year's DEIS, which were very late, and which your office assured me would be considered in planning any future Maine Spruce Budworm Suppression Projects. Thank you.

Sincerely,

Barbara Lapham

Barbara Lapham

(37) DEC 29

STATE OF MAINE

Department of Environmental Protection

MAIN OFFICE: RAY BUILDING, HOSPITAL STREET, AUGUSTA
MAIL ADDRESS: State House Station 17, Augusta, 04333

JOSEPH E. BRENNAN
GOVERNOR

HENRY E. WARREN
COMMISSIONER

December 16, 1980

Mr. Peter W. Orr
Forest Pest Management
Northeaster Area State and Private Forestry
370 Reed Road
Broomall, Pennsylvania 19008

Dear Mr. Orr:

As usual it is our responsibility to review the Draft Environmental Impact Statement (DEIS). Since this DEIS is a five year program statement regarding the spruce budworm management for Maine and underscores the Integrated Pest Management (IPM) concept, we are pleased. 14

My biological staff have completed the review and recommend our position to support (Alternative 3) of the five proposed. We feel that at last the concept of IPM will be used which reduces the dependency on hard pesticides and encourages the use of biological pesticides. Also the increased use of silvicultural methods to harvest and salvage the unprotected areas is very good. With time and the reduction of fir stands it will hopefully reduce budworm infestation. 15

We have discussed these ideas and concepts in previous DEIS reviews. Its very encouraging and therefore we also trust that others will support Alternative 3.

Yours truly,

Henry E. Warren
Commissioner

cc: Steve Groves
Matthew Scott

HEW/MS/ad

(38)

DEC 29 1980

United States Department of the Interior

OFFICE OF THE SECRETARY
Northeast Region
15 State Street
Boston, Massachusetts 02109

In Reply Refer To:
ER 80/1248

December 19, 1980

Mr. Peter W. Orr
USDA Forest Service
State and Private Forestry
370 Reed Road
Broomall, Pennsylvania 19008

Dear Mr. Orr:

The Department has reviewed the Draft Environmental Impact Statement for the Proposed Cooperative 5-year (1981-1985) Spruce Budworm Management Program for Maine, Draft Programmatic Environmental Impact Statement. The draft describes the spruce budworm problem, management alternatives and impacts as related to a cooperative program.

Since insecticides have been used for several years and most likely will continued to be used to some degree in the future, we feel that the management program should include appropriate monitoring and studies to assess the long-term effects of spraying. The impact of reduced populations of aquatic and terrestrial insects on those species, particularly fish and birds, that feed on these insects needs to be addressed. 9

We suggest that the statement consider water-quality monitoring of streams draining the spray-target areas and spray-aircraft staging areas. Such measures would be helpful in assessing effects on water resources that may result from any excessive insecticide application on target areas and any insecticide spills in staging areas. 13

Sincerely yours,

William Patterson

William Patterson
Regional Environmental Officer

APPENDIX N

MAILING LIST FOR FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT.

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FEDERAL

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Assistant Secretary for Health & Scientific Affairs
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Roger Leighton
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Mayhew Library Assoc.
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Andover Public Library
Andover, ME 04216

Ashland Community Library
Ashland, ME 04732

Woodland Public Library
Woodland, ME 04694

Bangor Public Library
Bangor, ME 04401

Jesup Memorial Library
Bar Harbor, ME 04609

Bingham Union Library
Bingham, ME 04920

Brownville Free Public Library
Brownville, ME 04414

Calais Free Library
Calais, ME 04619

Caribou Public Library
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Thompson Free Library
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Florence Sturdivant Public Library
East Machias, ME 04630

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Peavey Memorial Library
Eastport, ME 04631

Stratton Public Library
Stratton, ME 04982

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Unity College Library
Unity, ME 04988

Fort Fairfield Public Library
Fort Fairfield, ME 04742

Prospect Harbor Public Library
Prospect Harbor, ME 04669

Shaw Public Library
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Guilford Memorial Library
Guilford, ME 04443

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Harrington, ME 04643

Cary Library
Houlton, ME 04730

Thomas Free Library
Howland, ME 04448

Katahdin Public Library
Island Falls, ME 04747

Neighorhood House Library
Isleford, ME 04646

Jackman Public Library
Jackman, ME 04945

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Jonesport, ME 04649

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Kingfield, ME 04947

Robert A. Frost Memorial Library
Limestone, ME 04751

Lincoln Memorial Library
Lincoln, ME 04457

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Lubec, ME 04652

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Porter Memorial Library
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Madawaska Public Library
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Walter T. A. Hansen Memorial Library
Mars Hill, ME 04758

Mattawamkeag Public Libary
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Milbridge, ME 04658

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Millinocket, ME 04462

Milo Free Public Library
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Somesville Library Assoc.
Mount Desert, ME 04660

Northeast Harbor Library
Northeast Harbor, ME 04662

Seal Harbor Library
Seal Harbor, ME 04675

Old Town Public Library
Old Town, ME 04468

Harvey Memorial Library
Parkman
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Guilford, ME 04443

Veterans Memorial Library
Patten, ME 04765

Phillips Public Library
Phillips, ME 04966

Mark & Emily Turner Memorial Library
Presque Isle, ME 04769

Rangeley Public Library
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Sangerville Public Library
Sangerville, ME 04479

Sherman Public Library
Sherman Mills, ME 04776

Henry D. Moore Library
Steuben, ME 04680

Frenchman's Bay Library
Ashville, ME 04607

Bass Harbor Memorial Library
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Upton Public Library
Newry, ME 04261

Abel J. Morneault Memorial Library
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Washburn Memorial Library
Washburn, ME 04786

Weld Memorial Library
Weld, ME 04285

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College of the Atlantic Library
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University of Maine Library
at Fort Kent
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APPENDIX O

LETTER FROM THE STATE OF MAINE PROPOSING A 5-YEAR SPRUCE BUDWORM MANAGEMENT PROGRAM

September 9, 1980

Allen J. Schacht, Director
USDA Forest Service
Northeastern Area
State & Private Forestry
370 Reed Road
Broomall, PA 19008

Dear Al:

The Maine Forest Service is preparing a five year Integrated Pest Management Program for spruce budworm control during the years 1981-1985. This program consists of two components: foliage protection/population control, and forest management/utilization. The Maine Forest Service recommends and requests the establishment of a five year cooperative state-federal budworm management program.

Foliage protection strategies will be focused on a three million acre protection zone. This zone, equal to approximately 40% of the spruce-fir forest in Maine, has been reduced from the five million acre zone of 1976-1980. This reduction has been accomplished by expanding buffer zones around permanent habitations and publicly maintained roads, and through landowner withdrawals. A large proportion of this reduction may be attributed to selective abandonment.

Within this three million acre protection zone, a spray area of approximately one million acres will be chosen each year. Annual area treated may vary from 500,000 to 1,500,000 acres. The average of one million acres per year will be a significant reduction from the average annual spray project in 1976-1980 of 1.9 million acres. This will be accomplished through improved planning with landowenrs to achieve more precise targetting of spray on susceptible stands, through increased use of precision spray aircraft such as helicopters and small fixed wing aircraft, and through increased implementation of forest management practices.

Chemical sprays will average 850,000 to 1,000,000 acres per year, well below the 1976-1980 average of 1.85 million acres. Biological insecticide use will rise accordingly (as in 1980, where Bt comprised 15% of the total). Depending on further efficacy and reliability tests, future costs, and cost-sharing arrangements, Bt use may increase further.

Successful budworm control through forest management will require a high degree of cooperation between the state and federal governments, and the landowners. The landowners must necessarily take the lead in forest management, as only they have the information and the authority to implement management decisions on the ground. The Maine Forest Service, however, strongly encourages adaptive budworm forest management, and will continue to work towards coordination of public and private budworm management programs. The new Maine Spruce Budworm Management Act which takes effect October 1, 1981, will strengthen the cooperative budworm management ties between the Maine Forest Service and the landowners by requiring landowners to submit annual requests for lands to be included in that year's suppression program. In addition, taxes levied on landowners will be tied directly to acres sprayed each year, thus offering strong incentives to minimize the number of sprayed acres.

The Maine Forest Service has set targets in coordination with large landowners, for forest management activities during 1981-1985. Reduction in softwood and mixedwood stand vulnerability on large ownerships will come about through several means. In mature stands of heavy fir stocking, site preparation and planting of less susceptible species will take place on 15% of annual clearcut acres by 1985. In mature stands of intermediate fir stocking, fir-only cuts to reduce overall stand vulnerability will approach 100% of all non-clearcut spruce-fir harvests. In stands of low fir stocking, the fir component will be abandoned, and management will concentrate on the less-susceptible residual species. In immature spruce-fir stands, pre-commercial thinnings will reach at least 50,000 acres by 1985 and will be employed increasingly to control species composition on the 85% of clearcut acres which are naturally regenerated. Increased management of hardwood will also be a component of the budworm forest management plan. For industrial owners, hardwood thinnings are expected to increase at least 150% during the five year period, and non-industrial owners may increase hardwood management even more.

Small, non-industrial landowners are more restricted in their abilities to invest in budworm forest management because of limited available capital and lack of technical expertise. These owners will need financial and technical assistance if they are to manage their woodlots to control budworm. The Maine Forest Service will continue to provide technical assistance through the Budworm Woodlot Management Program, and requests continued federal financial support for this program.

Associated with and essential to budworm forest management are utilization technology and marketing. Industrial managers must work with forest managers to most effectively use an increasing volume of green and dead fir in 1981-1985, and to lessen the impact of the long term budworm caused fiber and timber short fall. The Maine Forest Service envisions active initiatives from private industry, and assistance in continuing utilization research from the federal government. Among appropriate changes in utilization technology might be: an increase in the utilization ratio of fir to other species in existing mills; the development of new markets for fir products such as fuel pellets and particle boards; the increased utilization of currently under-utilized species in existing and in new mills; and the modification of utilization standards toward smaller sizes, whole-tree chipping, and the use of damaged material.

Many of these utilization technologies and marketing strategies are already being implemented by Maine's forest industry; the Maine Forest Service encourages these changes, and supports continued federal assistance for utilization research.

A final component of Maine's budworm management plan is research. The Maine Forest Service will pursue research goals in cooperation with landowners and the federal government in six areas. Applied forest management research will continue to test such budworm forest management strategies as pre-commercial thinnings, planting of non-host species, and hardwood utilization. Population control research will conitnue to examine insecticides, spray technology, and alternative control methods such as fungi, viruses, pheromones, and parasites. Population survey and hazard rating research will seek improved methods of identifying areas of high budworm hazard relative to forest type, for use in forest management. The Wood/Supply Demand Study, just getting underway, will more clearly define the level of protection needed to maintain Maine's forest industry. The Spruce Sawlog Export Study will clarify economic issues involved in the export of Maine sawlogs to Canadian mills. Environmental monitoring research will continue with the goal of further identifying the effects of insecticide spraying, and identifying the buffers necessary to protect non-target organisms, including people.

The Maine Forest Service requests federal assistance in the five year Spruce Budworm Integrated Pest Management Program in the following areas:

Population Control/Foliage Protection

1. Continued financial assistance for budworm suppression.
2. Continued financial assistance for pesticide application technology.
3. Continued financial and technical assistance in budworm population survey and detection, and in development of improved hazard ratings.
4. Continued financial and technical assistance in developing alternative budworm population control mehtods.

Forest Management/Utilization

1. Continued financial assistance for the Budworm Woodlot Management Program.
2. Conitnued financial and technical assistance for forest management demonstration projects, such as Green Woods.
3. Financial assistance for research on improved fiber recovery and improved milling capability in cooperation with landowners.
4. Financial assistance for incentives for thinning and planting.

Research

1. Financial and technical assistance for the Wood Supply/Demand Study
2. Financial and technical assistance with an enlarged environmental monitoring program.

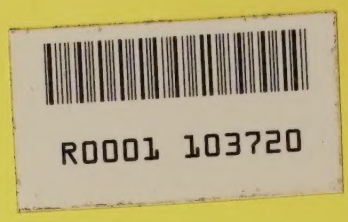
We in th Maine Forest Service appreciate this opportunity to present this brief outline of our five year Integrated Pest Management Program for the spruce budworm. As we further develop our plan we will continue to work cooperatively with landowners, the federal government, and others to assure, to the extent possible, a coordinated approach to the most important program.

Yours respectfully,

Kenneth G. Stratton, Director

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